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Nov. 16, 2009

Constructive Notice and Comment
(On California Department of Fish and Game (DFG) Notice of Preparation (NOP) for Suction Dredge Mining and Rule Making Process)

Public Lands for the People Inc. (PLP) and I appreciate the opportunity to participate in the rule making process for suction dredge mining in the state of California.

The purpose of our comments is to inform the DFG that in the process of doing their Environmental Impact Study (EIR) to promulgate Suction Dredge Regulations for the State of California, the DFG should seriously consider retaining an expert on Mining laws.

In the 1994 the DFG did not consider the ramifications of running afoul to the mining laws, the Constitutional protections, other applicable federal laws and the case law decisions on the rights of miners and mining claimants. If the DFG continues to ignore these laws in this present rule making process there will be serious ramifications in a court of law.

We have noticed that the DFG, NOP, on page 18 part 5.5.8 "Location", has apparently misinterpreted or does not understand the definition of what an exclusive right of a mining claim is or means, so we will address the correct meaning for the DFG.

"Many miners also own their own unpatented mining claims to which they have exclusive right only to the locatable minerals under there claim".

It is difficult to understand where the DFG got this particular description of exclusive "right **only** to the locatable minerals. Exclusive right of a mining claimant is all inclusive within the boundary's of the mining claim not just locatable minerals.

DISCUSSION: The Congress of the United States, as authorized by the Constitution, has the “exclusive” ¹ power “...to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States;” (Article IV).

In the Mining Acts of 1866 to 1872, the U.S. Congress, as authorized by the Constitution, declared ², in the form of a “grant” ³, to the citizens of the United States, that;

“... the mineral lands of the public domain, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and occupation by all citizens of the United States, and those who have declared their intention to become citizens, subject to such regulations as may be prescribed by law, and subject also to the local custom or rules of miners in the several mining districts, so far as the same may not be in conflict with the laws of the United States.” (H.B. 365, 39TH CONGRESS, IN THE SENATE OF THE UNITED STATES, JULY 19, 1866, Sec. 1). (emphasis added)

It is important to note that the only stipulations to the grant is that it is made “... subject to such regulations as may be prescribed by law...” and “...to the local custom or rules of miners...”. In order to pursue the purpose of this examination (i.e.; to determine what rights, if any, are granted by the 1866-1872 Mining Acts), it is deemed advantageous to First determine what “... regulations as may be prescribed by law,” the grant is or may be subject to.

We look to the United States Codes for the answer, in particular, 30 USC, Chpt. 2, Sec. 26, under the heading, “Locators' rights of possession and enjoyment”; where it clearly states:

“... so long as they comply with the laws of the United States, and with State, territorial, and local regulations not in conflict with the laws of the United States governing their possessory title...” (emphasis added)

So here, in the U.S. Codes, we see that so long as the locators (miners and prospectors) comply with “*the laws of the United States...*”, and State, territorial, and local “regulations” (as long as they are not in conflict with the laws of the United States) “...governing their possessory title...” ... they qualify for and/or meet the

¹ **Exclusive.** Appertaining to the subject alone, not including, admitting, or pertaining to any others. **Sole.** Shutting out; debarring from interference or participation; vested in one person alone. (Black's Law Dictionary, 5th Edition, 1979) (emphasis added)

² **Declare.** To make known, manifest, or clear. To signify, to show in any manner either by words or acts. To solemnly assert a fact before witnesses. (Black's Law Dictionary, 5th Edition, 1979)

³ **Grant.** To bestow; to confer upon someone other than the person or entity which makes the grant. Porto Rico Ry., Light & Power Co. v. Colom, C.C.A.puerto Rico, 106 F.2d 345, 354. To bestow or confer, with or without compensation, a gift or bestowal by one having control or authority over it, as of land or money. Palmer v. U.S. Civil Service Commission, D.C.Ill., 191 F.Supp. 495, 537.

stipulations of the grant. It is important to note — no, indeed, it is vital to note -- that the statutes do not even hint at or mention any other laws, rules, or regulations that the grantee is subject to; other than the local customs or rules of miners.

So just what are these “**laws of the United States, and with State, territorial, and local regulations**” that govern possessory title? These are the federal, state, and local laws, rules, and regulations that we all follow regarding the locating and keeping of a mining claim. In other words, the laws spelling out what must be done to have a valid Discovery and what information must be included in a “Notice of Location”, “Affidavit of Labor”, “Quit-Claim Deed”, and other similar documents; when such documents must be filed; what markers, if any, are required to mark the boundaries of the claim; and in some states, what taxes, if any, must be paid. It is important to note that there is no mention what-so-ever restricting mining methods, or for protecting the environment, for reclamation, or seeking approval from a land management agency and posting of a bond.

A conveyance; i.e. transfer of title by deed or other instrument. *Dearing v. Brush Creek Coal Co.*, 182 Tenn. 302, 186 S.W.2d 329, 331. Transfer of property real or personal by deed or writing. *Commissioner of Internal Revenue v. Plestcheeff*, C.C.A.9, 100 F.2d 62, 64, 65. A generic term applicable to all transfers of real property, including transfers by operation of law as well as voluntary transfers. *White v. Rosenthal*, 140 Cal.app. 184, 35 P.2d 154, 155. A technical term made use of in deeds of conveyance of lands to import a transfer. A deed for an incorporeal interest such as a reversion.

As distinguished from a mere license, a grant passes some estate or interest, corporeal or incorporeal, in the lands which it embraces.

Now then; Section 26 (30 USC) goes on to say that as long as the locators of all mining locations comply with the laws of the United States, and with State, territorial, and local regulations not in conflict with the laws of the United States governing their possessory title that the locators of all mining locations on the public domain:

“...shall have the exclusive right of possession and enjoyment of all the surface included within the lines of their locations...” (emphasis added)

Use of the word “shall” ^{4, 5} means “must” (or “does”) have, in the highest order. Lesser direction would be something like “may”, “might”, etc.. In this usage, “shall” is an absolute, i.e.; the same as “must, in all cases and in all circumstances”. And what “shall” the locator of a mining location have as long as they comply with the laws of the United States, and with State, territorial, and local regulations not in conflict with the laws of the United States governing their **possessory title**? Nothing short of “...**the exclusive right of possession and enjoyment of all the surface...**”.

We’ve seen in footnote 1 that “*exclusive right*” means “**Not including, admitting, or pertaining to any others. Sole. Shutting out; debarring from interference or participation; vested in one person alone.**” (Black’s Law Dictionary, 5th Edition, 1979) (emphasis added) As stated above, Congress, through the Constitution, has the “exclusive right” to “...**dispose of... the Territory or other Property belonging to the United States.**” No other branch of government has this authority. The miner’s “*exclusive rights*” to possession and enjoyment of their mineral location is just as strong and binding as Congress’s “exclusive right” to dispose of territory or other property belonging to the United States.

In other words, according to 30 USC, Chpt. 2, Sec. 26, as long as the locator of a mining location on the public domain complies with the laws and regulations governing the possessory title (to the location), then the locator “**shall have the exclusive right of possession and enjoyment of all the surface...**”. This can only mean one (1) thing; the language is simple. The law says “**exclusive right of possession and enjoyment**”. This right can not be “exclusive” if it is in any way influenced or interfered with by any outside source, such as and including the various land management agencies. Indeed, any such restriction or regulation of bone fide mining operations makes a mockery of the term “exclusive”. How can something be “exclusive” if it is shared or subject to outside control? It can’t.

“...**Exclusive right of possession and enjoyment of all the surface...**”; that’s what the law declares, and grants. How can the locator’s “exclusive right of possession and enjoyment” be “exclusive” if it is secondary to the management of the U.S. Forest Service, the Bureau of Land Management, or other federal, state, and local governments?

⁴ shall 3. (*in laws, directives, etc.*) must; is or are obligated to... (Random House Webster’s College Dictionary – 1991)

⁵ Shall. As used in statutes, contracts, or the like, **this word is generally imperative or mandatory**. In common or ordinary parlance, and in its ordinary signification, the term “shall” is a word of command, and one which has always or which must be given a compulsory meaning; as denoting obligation. It has a peremptory meaning, and it is generally imperative or mandatory. **It has the invariable significance of excluding the idea of discretion**, and has the significance of operating to impose a duty which may be enforced, particularly if public policy is in favor of this meaning, or when addressed to public officials, or when public interest is involved, or where the public or persons have rights which ought to be exercised or enforced, unless a contrary intent appears. *People v. O’Rourke*, 124 Cal.App. 752, 13 P.2d 989, 992.

How can it be “exclusive” if it is secondary to the interests of fish, plants, bugs, and other critters? It can’t. How can the locator’s “exclusive right” to the “enjoyment” of all the surface be “exclusive” if the state can tell him when he can mine, how he can mine, or with what size equipment (or worse, that he can’t mine). . . or if the Forest Service or BLM can restrict the methods of mining and even occupancy of the surface itself? All of these things (and dozens of others) totally and completely ignore the concept of “exclusive rights”.

Some may say that the use of the term “exclusive right” is a mistake... or that it doesn’t really mean “exclusive”. However, a look at some of the other guarantees or rights granted in the Mining Acts of 1866 – 1872 may shed light on this subject.

INTENT: The intent of the Mining Laws and the continuing intent of Congress is simple and self-evident:

- **The general policy of the mining laws is to promote widespread development of mineral deposits and to afford mining opportunities to as many persons as possible.** (30 USC 22.50) (emphasis added)

and;

The Congress declares that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs... For the purpose of this Act ‘minerals’ shall include all minerals and mineral fuels including oil, gas, coal, oil shale and uranium. (Mining and Minerals Policy Act of 1970) (emphasis added)

RIGHTS TO EXCLUSIVE POSSESSION: Not only is the public domain already the land of whomsoever would desire to occupy the land (due to the grants of 1866 – 1872), which land is now held in trust ⁶ for him, but that the right of possession is exclusively his; to hold and enjoy. This possession is clearly guaranteed by the statutes:

- So long as the locator complies with statutory requirements and performs assessment work he is **entitled to hold his possession against all the world**, subject to the paramount sovereignty of

⁶ **Trust.** A right of property, real or personal, held by one party for the benefit of another. King v. Richardson, C.C.A.N.C., 136 F.2d 849, 856, 857. A confidence reposed in one person, who is termed trustee, for the benefit of another, who is called the cestui que trust, respecting property which is held by the trustee for the benefit of the cestui que trust. State ex rel. Wirt v. Superior Court for Spokane County, 10 Wash.2d 362, 116 P.2d 752, 755. Any arrangement whereby property is transferred with intention that it be administered by trustee for another’s benefit.

A fiduciary relation with respect to property, subjecting person by whom the property is held to equitable duties to deal with the property for the benefit of another person which arises as the result of a manifestation of an intention to create it. An obligation on a person arising out of confidence reposed in him to apply property faithfully and according to such confidence; as being in nature of deposition by which proprietor transfers to another property of subject intrusted, not that it should remain with him, but that it should be applied to certain uses for the benefit of third party. (Black’s Law Dictionary, 5th Edition, 1979) (emphasis added)

The United States, and the legal title is held by the government in trust for him. (30 USC 28.36) (emphasis added)

and;

- By the terms of this section the locator of a mining claim has a possessory title thereto and the right to the exclusive possession and enjoyment thereof, and this includes the right to work the claim, to extract the minerals therefrom, the right to the exclusive property in such mineral as well as the right to defend his possession. (30 USC 22.70) (emphasis added)

NOTE: 30 USC 28.36 states that “...**the legal title is held by the government in trust for him.**” and that the definition in Blacks Law Dictionary for the term “trust” (see footnote 6), second paragraph reads:

A fiduciary relation with respect to property, subjecting person by whom the property is held to equitable duties to deal with the property for the benefit of another person which arises as the result of a manifestation of an intention to create it. (emphasis added)

This means that the United States is acting as “trustee” in a “*fiduciary* ⁷ relationship” when they hold the legal title “*in trust*” for the locator (present or future) of a mineral location. And as the “trustee” of the Mineral Estate, the government is obligated and bound by both the law and the courts “...to act primarily for another’s benefit in matters connected with such undertaking” and “...to follow the terms of the trust and the requirements of applicable state law.” Or in other words, the government, as the trustee of the Mineral Estate, is obligated to place its primary importance in the benefit of the locator of a mineral location.

Furthermore, “A breach of fiduciary responsibility would make the trustee liable to the beneficiaries for any damage caused by such breach.” (see footnote 7) (emphasis added)

So, as trustee of the Mineral Estate, the government is obligated to act primarily for the benefit of the locator of a mineral location, and a breach of this trust makes the trustee liable to the beneficiaries for any damage caused by such breach. As the statutes state, the locator of a mineral location shall have the right to the exclusive possession and enjoyment thereof, and this includes the right to work the claim, to extract the minerals therefrom, the right to the exclusive property in such mineral as well as the right to defend his possession. (30 USC 22.70) (emphasis added)

⁷ **Fiduciary.** The term is derived from the Roman law, and means (as a noun) a person holding the character of a trustee, or a character analogous to that of a trustee, in respect to the trust and confidence involved in it and the scrupulous good faith and candor which it requires. A person having duty, created by his undertaking, to act primarily for another’s benefit in matters connected with such undertaking. As an adjective it means the nature of a trust; having the characteristics of a trust; analogous to a trust; relating to or founded upon a trust or confidence.

A person or institution who manages money or property for another and who must exercise a standard of care in such management activity imposed by law or contract; e.g. executor of estate; receiver in bankruptcy; trustee. A trustee, for example, possesses a fiduciary responsibility to the beneficiaries of the trust to follow the terms of the trust and the requirements of applicable state law. A breach of fiduciary responsibility would make the trustee liable to the beneficiaries for any damage caused by such breach. (Black’s Law Dictionary, 5th Edition, 1979) (emphasis added)

In this light, it is plain that as the trustee of the Mineral Estate, the government is charged with making the protection of the "exclusive possession and enjoyment" of the location for the locator its primary duty and responsibility.

RIGHT TO SETTLE: The locator of a mining claim is viewed as a settler⁸ in the land, and that he may do whatever he has need of which is conducive or incident to his mining effort. The Mining Acts, by provision, as well as by injunction, provides that any prudent man who would carry on any mineral extraction in the forests is regarded as a settler. A settler is one who comes on the land with the intent of settling and establishing himself on the land:

-
- 30 USC 26.91 – **The Rights of one entering upon the public domain and locating and working an mineral claim are as of the high order as those of a settler each of whom is in possession under rights initiated which may be the observation of precedent conditions ripen into the right to a final patent. (emphasis added)**

PROPERTY RIGHTS:

- Unpatented mining claims are "property" in the highest sense of such term, which may be bought, sold and conveyed and will pass by decent. (30 USC 26.94)

Notice is given

I hereby officially request DFG's unlawful actions cease and desist immediately. Failure to do so could subject the Director to personal suit for damages and those individuals acting in concert. The Director may also be subject to prosecution by the Dept. of Justice for Violations of the Hobbs Act (18 U.S.C. 1951), which states in part:


"(a) Whoever in any way or degree obstructs, delays, or affects commerce or the movement of any article or commodity in commerce, by robbery or extortion or attempts or conspires so to do, or commits or threatens physical violence to any person or property in furtherance of a plan or purpose to do anything in violation of this section shall be fined under this title or imprisoned not more than twenty years, or both.

(b) As used in this section--

(1) The term "robbery" means the unlawful taking or obtaining of personal property from the person or in the presence of another, against his will, by means of actual or threatened force, or violence, or fear of injury, immediate or future, to his person or property, or property in his custody or possession, or the person or property of a relative or member of his family or of anyone in his company at the time of the taking or obtaining.

(2) The term "extortion" means the obtaining of property from another, with his consent, induced by wrongful use of actual or threatened force, violence, or fear, or under color of official right. Emphasis added

Respectfully Submitted


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President PLP

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The purpose of our comments is to inform the DFG that in the process of doing their Environmental Impact Study (EIR) to promulgate Suction Dredge Regulations for the State of California, DFG should seriously consider retaining an expert on Mining laws.

In the 1994 the DFG did not consider the ramifications of running afoul to the mining laws, the Constitutional protections, other applicable federal laws or the case law decisions on the rights of miners and mining claimants. If the DFG continues to ignore these laws in this present rule making process there will be serious ramifications in a court of law.

We notice that the California Department of Fish and Game (DFG) in several places refer to the suction dredge community as recreational. Where ever the DFG gets such language from will most likely create a great problem down the line for them. There is no such creature, either in state law or federal law which creates a recreational suction dredger, prospector or miner and can only serve to take a miner out from under the protection of the rights granted under the mining law.

Recreation is a privilege in most cases and mining is a property right, a grant of land under the federal mining laws of 1866 and 1872. (30 USC 22 – 54). For the DFG to treat miners, prospectors or mining claim owners, (Mineral Estate Grantees) with the same disrespect as given to the recreational activities will certainly exceed DFG's regulatory authority.

Also it would appear that DFG believes they have discretion to regulate suction dredge mining to the point of prohibition. Case Law says that they can not prohibit prospecting or mining either temporarily or permanently.

In the Department of Fish and Game Notice of Preparation Document (DFG NOP) on page 21, last paragraph and I quote, **"In other words, the issuance of individual suction dredge mining permits consistent with regulations adopted by the Department under Fish and game Code section 5653.9 is an important aspect of the discretionary project being analyzed in the SEIR that the Department proposes to carry out and approve for the purposes of CEQA."**

In the Department of Fish and Game Notice of Preparation Document (DFG of NOP) on page 25, part 7.5, Final SEIR and Proposed Regulations, and I quote, **"The final SEIR, in turn inform the Department's exercise of discretion as a lead agency under CEQA in deciding whether to approve a the Proposed Program as prescribed by the Fish and Game Code."**

The DFG does not have discretion under CEQA or NEPA or any other state or federal law to prohibit suction dredge mining, temporarily or permanently, mining is not discretionary.

Definition of Discretionary Blacks Law Dictionary 9th Edition
(of an act or Duty) "involving an exercise of judgment and choice, not an implementation of hard-and-fast rule."

This language does not entertain the rights under the mining law but does offer an opportunity for the DFG to fall in an act of abuse of discretion.

Suction Dredge Mining nor any other form of modern day mining is discretionary and in the case of California's CEQA suction dredge mining is a ministerial action and can not be classified as discretionary. (CEQ Guidelines 15260 – 15285)

Definition of Ministerial Blacks Law Dictionary 9th Edition
"Of or relating to an act that involves obedience to instructions or laws instead of discretion, judgment, or skill..."

Discretionary is a Violation of Public Resources Code Section 21080-21098

21080. "(a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies.

State law under CEQA also is defined as to only apply to discretionary projects as quoted from section 21080 of the Public Resource code:

Discretionary is a violation of CALIFORNIA CODES PUBLIC RESOURCES CODE SECTION 21080-21098

21080. (a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies...

The Federal code states at 50 CFR § 402.03 (Applicability)

"Section 7 and the requirements of this Part apply to all actions in which there is discretionary Federal involvement or control."

The U.S. Supreme Court in 2007 clarified the meaning of "discretionary agency action" in Home Builders v. Defenders of Wildlife 127 S.Ct. 2518 at 2534 where they stated:

"Agency discretion presumes that an agency can exercise "judgment" in connection with a particular action. See

; see also Random House Dictionary of the English Language 411 (unabridged ed.1967) ("discretion" defined as "the power or right to decide or act according to one's own judgment; freedom of judgment or choice"). As the mandatory language of § 402(b) itself illustrates, not every action authorized, funded, or carried out by a federal agency is a product of that agency's exercise of discretion.

This history of the regulation also supports the reading to which we defer today. As the dissent itself points out, the proposed version of initially stated that "Section 7 and the requirements of this Part apply to all actions in which there is Federal involvement or control," (emphasis added); the Secretary of the Interior modified this language to provide (as adopted in the Final Rule now at issue) that the statutory requirements apply to "all actions in which there is discretionary Federal involvement or control," (emphasis added). The dissent's reading would rob the word "discretionary" of any effect, and substitute the earlier, proposed version of the regulation for the text that was actually adopted.

In short, we read to mean what it says: that § 7(a)(2)'s no-jeopardy duty covers only discretionary agency actions and does not attach to actions (like the NPDES permitting transfer authorization) that an agency is required by statute to undertake once certain specified triggering events have occurred. This reading not only is reasonable, inasmuch as it gives effect to the ESA's provision, but also comports with the canon against implied repeals because it stays § 7(a)(2)'s mandate where it would effectively override otherwise mandatory statutory duties."

A miner operating under the Mining Law statute has a non-discretionary agency "advisory" relationship. A miner cannot be legally tortured into a CEQA, NEPA or ESA scenario. The law also, as the Supreme Court ruled, "**stays" the application of the ESA "where it would effectively override otherwise mandatory statutory duties"** like (for the purposes of this discussion) the Mining Law.

Violation of National Environmental Policy Act (NEPA)

Under "C Programmatic Analysis and Tiering", non-discretionary activities such as locatable minerals exploration, as well as pick and shovel work and suction dredging where T&E species exist, could be facilitated under programmatic analyses" In 1994 the California Department of Fish and Game completed their EIR on suction dredging and determined that it was not deleterious to fish, in accordance with following the regulations as adopted. This should be sufficient until a new EIR is completed.

To illustrate this concept the Supreme Court has said:"A contract is a compact between two or more parties, and is either executory or executed. An executory contract is one in which a party binds himself to do, or not to do, a particular thing;...." "A contract executed is one in which the object [10 U.S. 87, 137] of contract is performed; and this, says Blackstone, differs in nothing from a grant...." **"A contract executed, as well as one which is executory, contains**

obligations binding on the parties. A grant, in its own nature, amounts to an extinguishment of the right of the grantor, and implies a contract not to reassert that right. A party is, therefore, always estopped by his own grant." Fletcher v. Peck, 10 U.S. 87 (1810)

The Public Lands cannot be "free and open" to exploration if the historical means of use by prospectors and miners can be prohibited by the State of California. The State of California may have the power to reasonably regulate activities not incident to mining upon the public lands, **but those same regulations fail when they operate to prohibit the customary usage by legitimate prospectors and miners on valid mining claims or in pursuit of such a claim.** These proposed statutory or regulatory amendments are prohibitive and not merely regulatory in fundamental character and, therefore, are unlawful as proposed. We call your attention to:

**The DFG can not prohibit through regulation or using their discretion
Ventura County v. Gulf Oil Corporation, 601 F.2d 1090 (1979)**

(2) Despite this extensive federal scheme reflecting concern for the local environment as well as development of the nations resources, Ventura demands a right of final approval. Ventura seeks to prohibit further activity by gulf until it secures an Open Space Use Permit which may maybe issued on whatever conditions Ventura determines appropriate, or which may never be issued at all. The federal Government has authorized a specific use of federal lands, and Ventura cannot prohibit that use, either temporarily or permanently, in an attempt to substitute its judgment for that of Congress.

Recreation is a privilege in most cases and mining is a property right, a grant of land under the federal mining laws of 1866 and 1872. (30 USC 22 – 54). For the DFG to treat miners, prospectors or mining claim owners, (Mineral Estate Grantees) with the same disrespect as given to the recreational activities will certainly exceed DFG's regulatory authority. It would appear that DFG believes they have discretion to regulate suction dredge mining to the point of prohibition. Case Law says that they can not prohibit prospecting or mining either temporarily or permantly.

Federal laws are always preeminent: once Congress passes laws that occupy an area, **no government at a lower tier, i.e., at the state or local level**, may pass laws that conflict with the federal laws.

As a miner operating under the U.S. Mining law (30 U.S.C. 22-54) **has a non-discretionary agency "advisory" relationship.** A miner cannot be legally tortured into a CEQA, NEPA, CWA, or ESA scenario. The law also, as the Supreme Court ruled, "stays" the application of the ESA "where it would effectively override otherwise mandatory statutory duties" like (for the purposes of this argument) the mining law. The mining law (Congressional grant) does not by its very nature admit to a permissive system (lease system), otherwise the mining law would be rendered meaningless. The California Department of Fish and Game (DFG) does not authorize mining (the mining law does), the DFG does not fund mining, and the DFG does not carry out the mining, therefore mining under the U.S. Mining law is not by definition a "federal action" subject to the CEQA, NEPA or CWA due to this fact that federal and state involvement or control is non-discretionary in fundamental character. (See also Karuk v. Forest Service, Supra.)

In U.S. v. Weiss 642 F.2d at 296:

"Although authority exists for the promulgation of regulations, those regulations may, nevertheless, be struck down when they do not operate to accomplish the statutory purpose or where they encroach upon other statutory rights."

Granite Rock v. US

"...County ordinance is preempted because it conflicts with federal law. Specifically, we address whether the ordinance conflicts with the Federal Mining Act because it stands as an obstacle to the accomplishment of the full purposes and objectives of Congress embodied in the Act. Granite Rock, 480 U.S. at 581, 107 S.Ct."

Dakota Mining Assoc. v. Lawrence County 155 F3d 1005 (8th Cir. 1998

Agency actions can often amount to prohibitions that impermissibly encroach upon the right to the use and enjoyment of placer claims for mining purposes (see 30 U.S.C 26). To reinforce this point, in South

Dakota Mining Assoc. v. Lawrence County 155 F3d 1005 (8th Cir. 1998), at 1011 the court stated: "...government cannot prohibit a lawful use of the sovereign's land that the superior sovereign itself permits and encourages. To do so offends both the Property Clause and the Supremacy Clause of the federal Constitution. The ordinance is prohibitory, not regulatory, in its fundamental character." Emphasis added.

30 U.S.C. 612(b)

so long as the agency regulatory authority over the miner does not become prohibitive. If the miner can work out a reasonable agreement, i.e. contract generally through an "informational", then all is well. If not, then the miner can complain to the surface management agency through written administrative complaint or the appeal process and assert that the agencies actions are unreasonable, material interfering, prohibitive, and why, pursuant to 30 U.S.C. 612(b) (see also U.S. v. Curtis-Nevada Mines 611 F.2d 1277 at 1285).

Because environmental laws only apply in this setting. Namely the National Environmental Policy Act (NEPA-federal), the Endangered Species The Court stated in Karuk v. Forest Service 379 F.Supp.2d 1071 at 1094 (N.D. Cal. 2005):

"...mining operations take place pursuant to the General Mining Law and the Surface Resources Act, which confers a statutory right upon miners to enter certain public lands for the purpose of mining and prospecting. This distinction is significant, as it differentiates mining operations from "licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid," which are permissive in nature.

In fact, although Plaintiff vigorously argues that any act requiring "discretion" invokes the ESA, it is well-established that not every agency action triggers the consultation requirement of Section 7(a)(2) of the ESA. As the Ninth Circuit has made clear:

Within the limits prescribed by the Constitution, Congress undoubtedly has the power to regulate all conduct capable of harming protected species. However, Congress chose to apply section 7(a)(2) to federal relationships with private entities only when the federal agency acts to authorize, fund, or carry out the relevant activity.

Sierra Club v. Babbitt, 65 F.3d 1502, 1508 (9th Cir.1995) (emphasis added)."

And at 1095 the court stated:

. Marbled Murrelet, 83 F.3d. at 1074. Indeed, as the Ninth Circuit stated in Marbled Murrelet: Protection of endangered species would not be enhanced by a rule which would require a federal agency to perform the burdensome procedural tasks mandated by section 7 [of the ESA] simply because it advised or

consulted with a private party. Such a rule would be a disincentive for the agency to give such advice or consultation. Moreover, private parties who wanted advice on how to comply with the ESA would be loathe to contact the [agency] for fear *1103 of triggering burdensome bureaucratic procedures. As a result, desirable communication between private entities and federal agencies on how to comply with the ESA would be stifled, and protection of threatened and endangered species would suffer.
Id. at 1074-75.

State law under CEQA also is defined as to only apply to discretionary projects as quoted from section 21080 of the Public Resource code:

CALIFORNIA CODES
PUBLIC RESOURCES CODE
SECTION 21080-21098

21080. (a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies...

Conclusion and Property Rights

Conclusion: The suction dredge miners and prospectors are not to be regulated under the discretion of any agency but only the non-discretionary or ministerial regulatory process.

- Unpatented mining claims are "property" in the highest sense of such term, which may be bought, sold and conveyed and will pass by decent. (30 USC 26.94)

Notice is given

I hereby officially request DFG's unlawful actions cease and desist immediately. Failure to do so could subject the Director to personal suit for damages and those individuals acting in concert. The Director may also be subject to prosecution by the Dept. of Justice for Violations of the Hobbs Act (18 U.S.C. 1951), which states in part:

"(a) Whoever in any way or degree obstructs, delays, or affects commerce or the movement of any article or commodity in commerce, by robbery or extortion or attempts or conspires so to do, or commits or threatens physical violence to any person or property in furtherance of a plan or purpose to do anything in violation of this section shall be fined under this title or imprisoned not more than twenty years, or both.

(b) As used in this section--

- (1) The term "robbery" means the unlawful taking or obtaining of personal property from the person or in the presence of another, against his will, by means of actual or threatened force, or violence, or fear of injury, immediate or future, to his person or property, or property in his custody or possession, or the person or property of a relative or member of his family or of anyone in his company at the time of the taking or obtaining.
- (2) The term "extortion" means the obtaining of property from another, with his consent, induced by wrongful use of actual or threatened force, violence, or fear, or under color of official right." Emphasis added

Respectfully Submitted



Gerald Hobbs

President PLP

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Mark Stopher
California Department of Fish and Game
601 Locust
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Dec. 1, 2009

Constructive Notice and Comment

(On California Department of Fish and Game (DFG) Notice of Preparation (NOP) for Suction Dredge Mining and Rule Making Process)

Public Lands for the People Inc. (PLP) and I appreciate the opportunity to participate in the rule making process for suction dredge mining in the state of California.

The purpose of our comments is to inform the DFG that in the process of doing their Environmental Impact Study (EIR) to promulgate Suction Dredge Regulations for the State of California, the DFG should seriously consider retaining an expert on Mining laws.

Not unlike the California Department of Fish and Game (DFG), Public Lands for the People Inc. (PLP), has a job to do. The DFG must go by the rules of the Court and the Legislature and PLP must defend the rights that are conveyed to the mining community. This document is PLP's information to the DFG to see that the laws of the land are adhered too in their Rule Making Process.

We respectfully request that the State of California Department of Fish and Game (DFG) et al., in the drafting and or implementing of any restrictions or prohibitions what-so-ever on any and all prospecting and mining activities (including suction dredging mining) that are being performed under the grants of the U.S. Mining Laws of 1866 and 1872, please keep in mind that by the grants themselves within the 1866 and 1872 Mining Laws, miners and prospectors have very unique and specific "rights" entertained by no other members of the public. The U.S. Mining Laws not only grant the claim owner a right of ownership of the minerals on his or her claims, but they also grant the right to mine and extract those minerals. Any unnecessary or unreasonable restriction or prohibition in the acquisition of those minerals on legitimate mining claims would constitute a "taking".

Many of the suction dredge mining community are **Citizens** of the State of California. They are also **Citizens** of the United States of America, and as such, have rights

conveyed to them under Federal Statutes and have protections under the 5th and 14th

Amendments to the Constitution of the United States and the property rights guaranteed under the Constitution of the State of California.

The Fifth Amendment to the United States Constitution, made applicable to state and local governments by the Fourteenth Amendment, prohibits the government from taking private property for public use without just compensation.

The California Constitution provides, "Private property may be taken or damaged for public use only when just compensation ... has first been paid to, or into court for, the owner." (Cal. Const., art. I, § 19.)

CALIFORNIA ADMISSION TO UNION

Act for the Admission of California Into the Union

Volume 9

Statutes at Large

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Whereas, the people of California have presented a constitution and asked admission into the Union, which constitution was submitted to Congress by the President of the United States, by message date February thirteenth, eighteen hundred and fifty, and which, on due examination, is found to be republican in its form of government:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress Assembled, That the State of California shall be one, and is hereby declared to be one, of the United States of America, and admitted into the Union on an equal footing with the original States in all respects whatever.

Sec. 2. And be it further enacted, That until the representatives in Congress shall be apportioned according to an actual enumeration of the inhabitants of the United States, the State of California shall be entitled to two representatives in Congress.

Sec. 3. And be it further enacted, That the said State of California is admitted into the Union upon the express condition that the people of said State, through their legislature or otherwise, **shall never interfere with the primary disposal of the public lands within its limits, and shall pass no law and do no act whereby the title of the United States to, and right to dispose of, the same shall be impaired or questioned;**

and that they shall never lay any tax or assessment of any description whatsoever upon the public domain of the United States, and in no case shall non-resident proprietors, who are citizens of the United States, be taxed higher than residents;

and that all the navigable waters within the said State shall be common highways, and forever free, as well to the inhabitants of said State as to the citizens of the United States, without any tax, impost, or duty therefor.

Provided, That nothing herein contained shall be construed as recognizing or rejecting the propositions tendered by the people of California as articles of compact in the ordinance adopted by the convention which formed the Constitution of that State.

Approved, September 9, 1850.

THIS IS THE IMPORTANT PART

"shall never interfere with the primary disposal of the public lands within its limits, and shall pass no law and do no act whereby the title of the United States to, and right to dispose of, the same shall be impaired or questioned"

The General Mining Law is a land disposal law.

Under those Statutes is the Mining Law of 1872, covered under 30 U.S.C.A. 21 thru 54, and along with other laws; it grants a right to the public to free and open access to the public lands not reserved; for the purposes of exploration for, the claiming of, and the mining of valuable minerals. Pursuant to Federal Law,

"...the locator of a mining claim has a possessory title thereto and the right to the exclusive possession and enjoyment thereof, and this includes the right to work the claim, to extract the minerals therefrom, the right to the exclusive property in such mineral as well as the right to defend his possession." (30 USC 22.70); and "Unpatented mining claims are "property" in the highest sense of such term..." (30 USC 26.94).

The U.S. Mining Laws of 1866 and 1872 do not award a mere privilege but instead they **grant the right to real property**, the mining claim holder is a "Mineral Estate Grantee". The right to go upon the open public lands freely for the purpose of prospecting, discovery, exploration, claiming of the minerals upon that land, mining that land for minerals and taking that land to patent. In other words they get to make a living. The Mineral Estate Grantee has accepted a grant from the United States Government and is executing that grant (Mining Acts of 1866 and 1872) through the act of prospecting, locating, filing and mining the minerals located under that grant, **that grant being an executed contract.**

To illustrate this concept the Supreme Court has said:

"A contract is a compact between two or more parties, and is either executory or executed. An executory contract is one in which a party binds himself to do, or not to do, a particular thing;...." "A contract executed is one in which the object [10 U.S. 87, 137] of contract is performed; and this, says Blackstone, differs in nothing from a grant...." "A

contract executed, as well as one which is executory, contains obligations binding on the parties. A grant, in its own nature, amounts to an extinguishment of the right of the grantor, and implies a contract not to reassert that right. **A party is, therefore, always estopped by his own grant."** Fletcher v. Peck, 10 U.S. 87 (1810)

The Public Lands cannot be "**free and open**" to exploration if the historical means of use by prospectors and miners can be prohibited by the State of California. The State of California may have the power to reasonably regulate activities not incident to mining upon the public lands, but those same regulations fail when they operate to prohibit the customary usage by legitimate prospectors and miners on valid mining claims or in pursuit of such a claim. **These proposed statutory or regulatory amendments are prohibitive and not merely regulatory in fundamental character and, therefore, are unlawful as proposed.** We call your attention to:

INTENT: The intent of the Mining Laws and the continuing intent of Congress is simple and self-evident:

- **The general policy of the mining laws is to promote widespread development of mineral deposits and to afford mining opportunities to as many persons as possible.** (30 USC 22.50) (emphasis added)

and;

The Congress declares that it is the continuing policy of the Federal Government in the national interest **to foster and encourage private enterprise in** (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs... For the purpose of this Act 'minerals' shall include all minerals and mineral fuels including oil, gas, coal, oil shale and uranium. (**Mining and Minerals Policy Act of 1970**) (emphasis added)

RIGHTS TO EXCLUSIVE POSSESSION: Not only is the public domain already the land of whomsoever would desire to occupy the land (due to the grants of 1866 – 1872), which land is now held in trust¹ for him, but that the right of possession is exclusively his; to hold and enjoy. This possession is clearly guaranteed by the statutes: So long as the locator complies with statutory requirements and performs assessment work he is **entitled to hold his possession against all the world**, subject to the paramount sovereignty of

**United States Court of Appeals, Ninth Circuit.
UNITED STATES of America, Plaintiff-Appellee,**

v.

Steve A. HICKS, Defendant-Appellant.

No. 01-30146.

D.C. No. CR-00-00001-DWM.

“Mineral rights are ownership in land, and therefore Lewis is a landowner.” See, e.g., United States v. Shoshone Tribe of Indians of Wind River Reservation in Wyo., 304 U.S. 111, 116, 58 S.Ct. 794, 82 L.Ed. 1213 (1938) (with respect to question of ownership, “[m]inerals ... are constituent elements of the land itself”); British-American Oil Producing Co. v. Bd. of Equalization of State of Mont., 299 U.S. 159, 164-65, 57 S.Ct. 132, 81 L.Ed. 95 (1936) (**finding a mineral estate an estate in land**); Texas Pac. Coal & Oil Co. v. State, 125 Mont. 258, 234 P.2d 452, 453 (1951) (“[l]ands as a word in the law includes minerals”). We need not decide whether the term “landowner” as it is used in Forest Service regulations and orders always includes owners of mineral estates. Here, the government conceded at oral argument that Lewis is a landowner under the terms of the closure order before us and thus exempt from this closure order. The landowner exemption in this closure order must necessarily apply to agents of landowners. For example, corporate landowners can only access their land through agents. **Hicks, as Lewis’s agent, is therefore also exempt.**

**U.S v. Shumway (Cite as: 1999 WL 1256285 (9th Cir.(Ariz.)) (1997)
No. 96-16480.**

“[W]hen the location of a mining claim is perfected under the law, it has the effect of a grant by the United States of the right of present and exclusive possession. The claim is property in the fullest sense of that ‘term.’ [FN39] The Court held that the owner of a perfected mining claim ‘is not required ... to secure patent from the United States; so long as he complies with all provisions of the mining laws, his possessory right, for all practical purposes of ownership, is as good as though secured by patent.’ [FN40]

South Dakota Mining Ass., inc. vs. Lawrence County, (155 F.3d 1005)

“The Supreme Court has set forth the analysis we must apply to determine if a state law is preempted by federal law: State law can be pre-empted in either of two general ways. If Congress evidences an intent to occupy a given field, any state law falling within that field is pre-empted. If Congress has not entirely displaced state regulation over the matter in question, state law is still pre-empted to the extent it actually conflicts with federal law, that is, when it is impossible to comply with both state and federal law, or where the state law stands as an obstacle to the accomplishment of the full purposes and objectives of Congress. A local government cannot prohibit a lawful use of the sovereign's

land that the superior sovereign itself permits and encourages. To do so offends both the Property Clause and the Supremacy Clause of the federal Constitution. **The ordinance is prohibitory, not regulatory, in its fundamental character.**” (emphasis added)

**Ventura County v. Gulf Oil Corporation (9th Circuit)
601 F.2d 1080**

“Despite this extensive federal scheme reflecting concern for the local environment as well as the development of the nations resources, Ventura demands a right of final approval. Ventura seeks to prohibit further activity by Gulf until it secures an open space use permit which may be issued on whatever conditions Ventura determines appropriate, or which may never be issued at all. The federal government has authorized a specific use of federal lands, and **Ventura cannot prohibit that use, either temporarily or permanently, in an attempt to substitute its judgment for Congress.**”

The Mining Act (30 U.S.C.A. § 22)

30 U.S.C.A. § 22 clearly states: “Except as otherwise provided, all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, shall be **free and open to exploration and purchase**, and the lands in which they are found to **occupation** and purchase, by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law, **and according to the local customs or rules of miners in the several mining districts**, so far as the same are applicable and not inconsistent with the laws of the United States”. (emphasis added)

Within the DFG NOP and future rule making process, it appears as though the State of California, in their infinite wisdom have concocted a plan to effectively close or heavily restrict all of the rivers and streams in the State of California from suction dredge mining, while creating a taking of the miner’s mineral estate, in violation of the Fifth Amendment and 14th amendments of the United States Constitution. The rule making process also appears to be contrary to federal law and frustrates its intent.

**National Mineral Policy Act (30 U.S.C.A. § 21(a))
30 U.S.C.A. § 21(a) clearly states:**

“The Congress declares that it is the continuing policy of the Federal Government in **the national interest to foster and encourage private enterprise** in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to

help assure satisfaction of industrial, security and environmental needs, (3) mining, mineral, and metallurgical research, including the use and recycling of scrap to promote the wise and efficient use of our natural and reclaimable mineral resources, and (4) the study and development of methods for the disposal, control, and reclamation of mineral waste products, and the reclamation of mined land, so as to lessen any adverse impact of mineral extraction and processing upon the physical environment that may result from mining or mineral activities.” (emphasis added)

The State of California cannot **“foster and encourage”** domestic mining if they use regulations that have a prohibitive, hostile and chilling effect. It is very troubling to see the State of California continue to use general prohibitions in another futile attempt to supplant the power of Congress. The State of California cannot prohibit that which Congress expressly authorized by the Mining Acts. Nor can the State of California effectively repeal said mining law through the use of general prohibitions or regulation. In other words, the State of California can not legally prohibit that which Congress authorized under the Mining Act, which in its self is a **“right of self-initiation”** under said act (see **“The Mining Law of 1872: A Legal and Historical Analysis** by Steven G. Barringer, Esq. 1989). No re-authorization of those rights can be given by the State of California, absent a specific act of Congress with the consent of the Mineral Estate Grantee.

The General Mining Law of 1872, is a clear unequivocal federal grant towards disposal of federal public domain lands, containing valuable minerals, open to such entry. **Absolutely guaranteeing the grantee’s the right to mine applicable valuable minerals they own, under reasonable regulation.**

The legislature of California accepted this express provision in 1850, thus as long as the Federal government retains title, the federal interest in providing free access to its own land **in order to promote mining is sufficient to preempt any state law that fundamentally bans such use.** Accordingly under standard preemption analysis any state legislation, or subsequent regulation that conflicts with this overriding federal purpose, must fail.

The purpose of the Mining Act is to encourage mining on federal lands. United States v. Weiss, 642 F.2d 296, 299 (9th Cir.1981) (Weiss); see also United States v. Goldfield Deep Mines Co., 644 F.2d 1307, 1309 (9th Cir.1981), cert. denied, 455 U.S. 907, 102 S.Ct. 1252, 71 L.Ed.2d 445 (1982).

Unpatented mining claims are self-initiated rights granted under the General Mining Law. Congress exercised that discretion in granting those rights under the law. (30 U.S.C.A. § 23, 27-28; 43 U.S.C.A. § 1744; Cole v. Ralph, 252 U.S. 286, 296 (1920).)

In ordinary English, a "claim " is merely a demand for something, or an assertion of a

right where the right has not been established. The phrase "mining claim" therefore probably connotes to most laymen an unsupported assertion or demand from which no legal rights can be inferred. **But that is emphatically not so, as follows;**

In law, the word "claim" in connection with the phrase "mining claim" represents a federally recognized right in real property. The Supreme Court has established that a mining "claim" is not a claim in the ordinary sense of the word—a mere assertion of a right—but rather is a property interest, **which is itself real property in every sense, and not merely an assertion of a right to property.** *Benson Mining & Smelting Co. v. Alta Mining & Smelting Co.*, 145 U.S.428 (1892)

Exclusive Rights

Locator's rights of possession and enjoyment. The locators of all mining locations ... situated on the public domain, their heirs and assigns, ... so long as they comply with the laws of the United States, and with State, territorial, and local regulations not in conflict with the laws of the United States governing their possessory title, **shall have the exclusive right of possession and enjoyment of all the surface included within the lines of their locations**". (for mining purposes)30 USC § 26.

Once the requirements of the General Mining Law have been met, the right granted by the statute is a **real and private property interest**. *Freese v. United States*, 639 F.2d 754, 757, 226 Ct.Cl. 252 cert. denied, 454 U.S. 827, 102 S.Ct. 119, 70 L.Ed.2d 103 (1981); *Oil Shale Corp. v. Morton*, 370 F.Supp. 108, 124 (D.Colo. 1973).

Valid unpatented mining claims are "**property in the fullest sense of that term.**" (*Wilbur v. United States ex rel. Krushnic*, 280 U.S. 306, 316 (1930).) Which entitles the owner "the right to extract all minerals from the claim without paying royalties to the United States." *Swanson v. Babbitt*, 3 F.3d 1348. Further entitling the holder to "the right to a flow of income from production of the claim." (*United States v. Locke*, 471 U.S. 84, 104 - 105 (1985).)

Even though title to the fee estate remains in the United States, these **unpatented mining claims are themselves property protected by the Fifth Amendment against uncompensated takings**. See *Best v. Humboldt Placer Mining Co.*, 371 U.S. 334 (1963); cf. *Forbes v. Gracey*, 94 U.S. 762, 766 (1876); U.S.C.A.Const. Amend. 5; *North American Transportation & Trading Co. v. U.S.*, 1918, 53 Ct.Cl. 424, affirmed 40 S.Ct. 518, 253 U.S. 330; *United States v. Locke*, 471 U.S. 84, 107, 105 S.Ct. 1785, 1799, 85 L.Ed. 2d 64 (1985); *Freese v. United States*, 639 F.2d 754, 757, 226 Ct.Cl. 252, cert. denied, 454 U.S. 827, 102 S.Ct. 119, 70 L.Ed. 2d 103 (1981); *Rybachek v. United States*, 23 Cl.Ct. 222 (1991).

Prospecting, locating and developing of mineral resources in the national forests may not be prohibited nor so unreasonably circumscribed as to amount to a prohibition. Weiss, 642 F.2d at 299, United States Court of Appeals, Ninth Circuit, (1980).

California law recognizes water rights by ownership of riparian land, appropriation, or prescription. Cal. Water Code § 2501. In re Water of Hallett Creek Stream Sys., 749 P.2d 324 (Cal. 1988), cert. denied sub nom. California v. United States, 488 U.S. 824 (1988). The California Supreme Court ruled that the federal government, as owner of nearly half the land in the state, held riparian water rights on the lands it set aside for particular federal purposes, **but that the extent of rights were determined with reference to the interests of other water users.** Id. at 327.

Supremacy Clause

“This Constitution, and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the authority of the United States, shall be the supreme Law of the land; and the Judges in every State shall be bound thereby, anything in the Constitution or Laws of any State to the Contrary notwithstanding.”

As long as the Federal government retains title, the federal interest in providing free access to its own land in order to **promote mining is sufficient to preempt any state law that fundamentally bans such use.** Thus under standard preemption analysis any state legislation, or regulation that conflicts with this overriding federal purpose, must fail.

Under the Supremacy Clause, any state law that conflicts with a federal law is preempted. Gibbons v. Ogden, 22 U.S. 1 (1824). Any state legislation which frustrates the full effectiveness of federal law is rendered invalid by the Supremacy Clause" regardless of the underlying purpose of its enactors, Perez v. Campbell, 402 U.S. 637, 651-52, 91 S.Ct. 1704, 29 L.Ed.2d 233 (1971)

A conflict exists if a party cannot comply with both state law and federal law. In addition, even in the absence of a direct conflict between state and federal law, a conflict exists if the state law is an obstacle to the accomplishment and execution of the full purposes and objectives of Congress. Crosby v. Nat'l Foreign Trade Council, 530 U.S. 363, 372-73 (2000).

Furthermore, the state here, either is not cognizant of, or intentionally ignores several

unequivocal constraints it is bound by. Article VI, Section 2, of the U.S. Constitution provides that the "... **Constitution, and the Laws of the United States ... shall be the supreme Law of the Land.**"

The Court of Appeals, Hansen, Circuit Judge, held that: (1) preemption claim was ripe, and (2) Federal Mining Act preempted ordinance. Affirmed; *South Dakota Mining Association Inc v. Lawrence County*, 155 F.3d 1005

Obligations binding on the parties. A grant, in its own nature, amounts to an extinguishment of the right of the grantor, and implies a contract not to reassert that right. A party is, therefore, always estopped by his own grant." Fletcher v. Peck, 10 U.S. 87 (1810)

The Public Lands cannot be "free and open" to exploration if the historical means of use by prospectors and miners can be prohibited by the State of California. The State of California may have the power to reasonably regulate activities not incident to mining upon the public lands, **but those same regulations fail when they operate to prohibit the customary usage by legitimate prospectors and miners on valid mining claims or in pursuit of such a claim.** These proposed statutory or regulatory amendments are prohibitive and not merely regulatory in fundamental character and, therefore, are unlawful as proposed. We call your attention to:

The DFG can not prohibit through regulation or using their discretion
Ventura County v. Gulf Oil Corporation, 601 F.2d 1090 (1979)

(2) Despite this extensive federal scheme reflecting concern for the local environment as well as development of the nations resources, Ventura demands a right of final approval. Ventura seeks to prohibit further activity by gulf until it secures and Open Space Use Permit which may maybe issued on whatever conditions Ventura determines appropriate, or which may never be issued at all. The federal Government has authorized a specific use of federal lands, and **Ventura cannot prohibit that use, either temporarily or permanently, in an attempt to substitute its judgment for that of Congress.**

Recreation is a privilege in most cases and mining is a property right, a grant of land under the federal mining laws of 1866 and 1872. (30 USC 22 – 54). For the DFG to treat miners, prospectors or mining claim owners, (Mineral Estate Grantees) with the same disrespect as given to the recreational activities will certainly exceed DFG's regulatory authority. It would appear that DFG believes they have discretion to regulate suction dredge mining to the point of prohibition. **Case Law says that they can not prohibit prospecting or mining either temporarily or permantly.**

Federal laws are always preeminent: once Congress passes laws that occupy an area, **no government at a lower tier, i.e., at the state or local level**, may pass laws that conflict with the federal laws.

As a miner operating under the U.S. Mining law (30 U.S.C. 22-54) has a **non-discretionary** agency “**advisory” relationship**. A miner cannot be legally tortured into a CEQA, NEPA, CWA, or ESA scenario. The law also, as the Supreme Court ruled, “stays” the application of the ESA “where it would effectively override otherwise mandatory statutory duties” like (for the purposes of this argument) the mining law. The mining law (Congressional grant) does not by its very nature admit to a permissive system (lease system), otherwise the mining law would be rendered meaningless. The California Department of Fish and Game (DFG) does not authorize mining (the mining law does), the DFG does not fund mining, and the DFG does not carry out the mining, therefore mining under the U.S. Mining law is not by definition a “federal action” subject to the CEQA, NEPA or CWA due to this fact that federal and state involvement or control is non-discretionary in fundamental character. (See also **Karuk v. Forest Service, Supra.**)

In U.S. v. Weiss 642 F.2d at 296:

“Although authority exists for the promulgation of regulations, those regulations may, nevertheless, be struck down when they do not operate to accomplish the statutory purpose or where they encroach upon other statutory rights.”

Granite Rock v. US

“...County ordinance is preempted because it conflicts with federal law. Specifically, we address whether the ordinance conflicts with the Federal Mining Act because it stands as an obstacle to the accomplishment of the full purposes and objectives of Congress embodied in the Act. Granite Rock, 480 U.S. at 581, 107 S.Ct.”

South Dakota Mining Assoc. v. Lawrence County 155 F3d 1005 (8th Cir. 1998

Agency actions can often amount to prohibitions that impermissibly encroach upon the right to the use and enjoyment of placer claims for mining purposes (see 30 U.S.C 26). To reinforce this point, in **South Dakota Mining Assoc. v. Lawrence County** 155 F3d 1005 (8th Cir. 1998), at 1011 the court stated: “...government cannot prohibit a lawful use of the sovereign's land that the superior sovereign itself permits and encourages. To do so offends both the Property Clause and the Supremacy Clause of the federal Constitution. The ordinance is **prohibitory, not regulatory, in its fundamental character.**” Emphasis added.

30 U.S.C. 612(b)

so long as the agency regulatory authority over the miner does not become prohibitive. If the miner can work out a reasonable agreement, i.e. contract generally through an “informational”, then all is well. If not, then the miner can complain to the surface management agency through written administrative complaint or the appeal process and assert that the agencies actions are unreasonable, material interfering, prohibitive, and why, pursuant to 30 U.S.C. 612(b) (see also **U.S. v. Curtis-Nevada Mines** 611 F.2d 1277 at 1285).

Because environmental laws only apply in this setting. Namely the National Environmental Policy Act (NEPA-federal), the Endangered Species Act. The Court stated in Karuk v. Forest Service 379 F.Supp.2d 1071 at 1094 (N.D. Cal. 2005): "...mining operations take place pursuant to the General Mining Law and the Surface Resources Act, which confers a statutory right upon miners to enter certain public lands for the purpose of mining and prospecting. **This distinction is significant, as it differentiates mining operations from "licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid," which are permissive in nature.**

The State of California was admitted into the Union upon the express condition that the people of said State, through their legislature or otherwise, shall never interfere with the primary disposal of the public lands within its limits, and shall pass no law and do no act whereby the title of the United States to, and right to dispose of, the same shall be impaired or questioned.

Commerce Clause

"But most important of all there was the development of, or more accurately the return to, 596 **the rationales by which manufacturing, 597 mining, 598 business transactions, 599 and the like**, which are antecedent to or subsequent to a move across state lines, are conceived to be part of an integrated commercial whole and therefore subject to the reach of the commerce power."

Today, the Supreme Court said about the Commerce Clause

"we do not have to consider that point" because the hiring of seven out-of-state employees and the purchase of supplies from Los Angeles showed that the mine was "engaged in commerce."

Mining equipment, vehicles, fuel from out of state, and interstate travel and out of state mining claim owners, suction dredge miners all have an effect on the overall economy of the United States. The State of California must recognize these issues. Along with the fact that federal funding that was received for all or parts of the past or present studies and environmental process's make them no less than a welfare recipient and subservient to uphold the laws of the donor of the grant. In this case the laws of the United States.

Funding for part or the entire project is federal funding and in accepting this federal funding, the State of California in doing so, have committed themselves to being under direction and obligation to follow federal law. If Federal funds are enjoyed by the State of California to do part, or the entire project they can not be inconsistent with Federal Law. And certainly the State of California can not come to a conclusion that they can prohibit a mining project for any reason, that of which even the Federal Government can not prohibit.

The current rule making process is putting a **totally unreasonable and unnecessary** burden on themselves, the Mineral Estate Grantee, the Ca. Department of Fish and Game, and the State of California, a burden that neither the State of California nor the Grantee can comply with, with any prudence or effectiveness.

Property Clause" The Congress shall have power to dispose of and make all needful Rules and Regulations respecting...property belonging to the United States "Property Clause", Article IV, Section 3, U.S. Constitution

Congress has overlooked a powerful tool for regulating within state jurisdictions: the **Property Clause** of the United States Constitution. The United States Government owns land in every state and approximately thirty percent of the total land in the United States. The federal government's authority to regulate its **property** within states derives from the **Property Clause** and has been described by the Supreme Court as **"without limitation."**

Multiple-Surface Use Act (30 U.S.C.A. § 612(b) & (615), 612(b) clearly states:

“Rights under any mining claim hereafter located under the mining laws of the United States shall be subject, prior to issuance of patent therefore, to the right of the United States to manage and dispose of the vegetative surface resources thereof and to manage other surface resources thereof **(except mineral deposits subject to location under the mining laws of the United States)**. Any such mining claim shall also be subject, prior to issuance of patent therefore, to the right of the United States, its permittees, and licensees, **to use so much of the surface thereof as may be necessary for such purposes or for access to adjacent land: Provided, however, That any use of the surface of any such mining claim by the United States, its permittees or licensees, shall be such as not to endanger or materially interfere with prospecting, mining or processing operations or uses reasonably incident thereto...**” (emphasis added)

If the “United States” themselves are prohibited from “any use” of the surface of a mining claim **(including so-called protection of fish) that endangers or materially interferes “...with prospecting, mining or processing operations or uses reasonably incident thereto...”**, then there is no legal way for the State of California to “**endanger or materially interfere...**” with a mining claimant or his representatives on a valid existing mining claim.

What prudent man would go into a business that requires expending the time for education, the cost for that education, cost to buy or file a claim, the cost of acquiring the equipment for that business without assuring him self an opportunity to make that business his lifetime goal for success and livelihood for himself and his family?

When a party decides to go in business whether it is a store or mining business, they have crucial investments. If the grantee applies and receives a license or a permit it should be protected as long as his activity is legal under the mining laws of the United States. It should be good until the grantee decides to make some major change that would affect conditions of that license or permit or grant. They should be guaranteed to work under that license or permit or grant. The Mineral Estate Grantee should be able to expect the same benefit that any other businessman would. Especially since the **Grant is just that, a grant (contract) and not a licensed or a permitted activity, that is not discretionary.** The Grantee has a contract with the Federal Government to do business, **not just a maybe**, and should not have to be concerned whether he is going to be able to suction dredge mine in the following years or months. He is under the Grandfather clause for his own protection.

Endangered Species Act

Suction Dredge Mining is not a recreational activity which would fall under the same regulatory scheme as recreation. Most suction dredgers are either valid mining claim owners or agents of claim owners and are consequently property owners in the truest sense of the word.

Karuk Tribe v United States Forest Service NO. C-04-4275 SBA

"Forest Service's acceptance of four notices of intent (NOI) to conduct mining operations in a National Forest, on basis that the operations were not likely to cause a significant disturbance of surface resources, did not constitute a "federal action" within the meaning of the Endangered Species Act (ESA) and thus did not violate its duty under ESA to comply with consultation requirements; **miners were all private entities, Service's review of the NOIs did not amount to an authorization, mining operations were authorized by statute rather than merely permissive, and Service had no discretionary control over the NOIs process.** Endangered Species Act of 1973, § 7(a)(2), 16 U.S.C.A. § 1536(a)(2); 50 C.F.R. § § 402.02, 402.03." (emphasis added)

Here we must address the **Endangered Species Act (ESA)**. It is one thing to protect an endangered or threatened species but not to the degree of taking ones use for of his property rights. For example the DFG does all of the mitigation allowed for on their own, in the process of their rule making all the while denying the miner any right to mitigation on an individual basis. Not all rivers have threatened or endangered species and the proof of harm is not conclusive in any of the scientific studies on any fish. Some streams do not even have fish especially anadramous fish or redd beds.

The U.S. Supreme Court in 2007 clarified the meaning of "discretionary agency action" in **Home Builders v. Defenders of Wildlife** 127 S.Ct. 2518 at 2534 where they stated:

“ Agency discretion presumes that an agency can exercise “judgment” in connection with a particular action. See Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 415-416, 91 S.Ct. 814, 28 L.Ed.2d 136 (1971); see also Random House Dictionary of the English Language 411 (unabridged ed.1967) (“discretion” defined as “the power or right to decide or act according to one's own judgment; freedom of judgment or choice”). As the mandatory language of § 402(b) itself illustrates, **not every action authorized, funded, or carried out by a federal agency is a product of that agency's exercise of discretion.**

This history of the regulation also supports the reading to which we defer today. As the dissent itself points out, the proposed version of § 402.03 initially stated that “Section 7 and the requirements of this Part apply to all actions in which there is Federal involvement or control,”48 Fed.Reg. 29999 (1983) (emphasis added); the Secretary of the Interior modified this language to provide (as adopted in the Final Rule now at issue) that the statutory requirements apply to “all actions in which there is discretionary Federal involvement or control,”51 Fed.Reg. 19958 (1986) (emphasis added). The dissent's reading would rob the word “discretionary” of any effect, and substitute the earlier, proposed version of the regulation for the text that was actually adopted.

In short, we read § 402.03 to mean what it says: that § 7(a)(2)'s no-jeopardy duty covers only discretionary agency actions and **does not attach to actions** (like the NPDES permitting transfer authorization) **that an agency is required by statute to undertake once certain specified triggering events have occurred.** This reading not only is reasonable, inasmuch as it gives effect to the ESA's provision, but also comports with the canon against implied repeals because it stays § 7(a)(2)'s mandate where it would effectively override otherwise mandatory statutory duties.”

Even if they spawning beds were present on a stretch of stream bed, they are not present on the full length of a mining claim. With that in mind it is incumbent on the DFG to look at the individual situation and determine what can be done to circumvent the problem or to allow the miner to mitigate a situation that arises

We were told by DFG representatives that a court case prevents the DFG from issuing special use permits, this categorically untrue. There is no court case or court decision addressing the fact that the DFG does not have authority to issue special use permits, as a matter of fact it is factual that if the DFG does not have authority to issue a special use permit it would stand that they do not have the authority to issue any permit for suction dredging at all.

National Association of Homebuilders v Defenders of Wildlife (2007)
(Cite as: 127 S.Ct. 2518)

“That in Applying Chevron, we defer to the agency’s reasonable interpretation of the ESA sec. 7 (a) (2) as applying only to “actions” in which there is discretionary

Federal involvement or control. 50 CFR sec. 402.03. (emphasis added)

“Court will not infer that subsequent statute repeals an earlier enactment, unless the later statute expressly contradicts original act, or unless such a construction is absolutely necessary in order for words of the later statute to have any meaning at all; outside of these limited circumstances, statute dealing with narrow, precise, and specific subject is not submerged by a later enacted statute covering more generalized spectrum.” (emphasis added)

(2) “regulation purporting to apply consultation and no-jeopardy mandates of the Endangered Species Act (ESA), which require federal agencies to consult with other agencies to ensure that proposed agency action is not likely to jeopardize any **endangered or threatened species, only in situations in which there is discretionary federal involvement or control,** was reasonable interpretation entitled to deference;” (emphasis added)

No where in the Endangered Species Act does it address the Mining Acts of 1866 or 1872. the State of California “may” (and PLP use’s the word “may” loosely) have authority to regulate suction dredge mining... but **Federal Law states that the regulations must be “reasonable”, necessary, and yet not materially interfere with the Mineral Grant.**

That means “reasonable” to the Mineral Estate Grantee (miner) as well as The State of California. For State of California to deny or prohibit temporarily or permanently the mining operation permit for any reason and to create a paper snafu with prohibition is not reasonable to the miner but in fact works to create a prohibition on mining, something even the Federal land management agencies have no authority to do.

This also leads us to the **denial by the DFG for year round mining on all mining claims (Mineral Estates) or prospecting efforts on California rivers, or not to issue Special Use Permits for extended seasons or larger or different equipment creates temporary or permanent take under the 5th amendment of the U.S. Constitution**. Without the ability of the miner to acquire the full year round use of their claims or rights to prospect is contrary to all property rights and mining laws, even under the California Constitution.

Arizona Cattle Growers Association v. United States Bureau of Land Management (CV-97-02416-DAE/CV-99-0673-RCB (9th Cir, 2001).

The 9th Circuit Court determined it was arbitrary and capricious for the federal government to (1) “issue or not issue an incidental take statement (ITS) not predicated on an actual “take” (2) “impose land use conditions under the ESA where there was no evidence that the species occupied the territory at issue or that a take would occur if the

land use permit(here grazing permits)were issued”, and (3)”issue an ITS that included terms that “so vague as to preclude compliance therewith”

Marbled Murrelet, 83 F.3d at 1074

"Finally, pursuant to **Marbled Murrelet**, the Court finds that Plaintiff's generalized challenge to the "discretionary" nature of the Forest Service's implementation of the NOI review process is insufficient to invoke the ESA. Although, here, the Forest Service engaged in an interactive process with the miners prior to the start of the 2004 mining season, which process involved a discussion of the types of activities that would be considered a significant disturbance of surface resources, this process is most properly considered the type of **"advisory" conduct that does not trigger the ESA.** **Marbled Murrelet, 83 F.3d. at 1074.** (emphasis added)

Indeed, as the Ninth Circuit stated in **Marbled Murrelet:**

“Protection of endangered species would not be enhanced by a rule which would require a federal agency to perform the burdensome procedural tasks mandated by section 7 [of the ESA] simply because it advised or consulted with a private party. Such a rule would be a disincentive for the agency to give such advice or consultation. **Moreover, private parties who wanted advice on how to comply with the ESA would be loathe to contact the [agency] for fear *1103 of triggering burdensome bureaucratic procedures.** As a result, desirable communication between private entities and federal agencies on how to comply with the ESA would be stifled, and protection of threatened and endangered species would suffer. Id. at 1074-75.” (emphasis added)

Pennsylvania Coal Mining Company v. Mahon (260 U.S. 393, 43 S. Ct. 158, 67 L. Ed. 322 (1922). The Court noted that regulatory activity can “go too far”.

Penn Central Transportation Co. v New York City, (438 U.S. 104, 98 S. Ct. 2646, 57 L. ED. 2d 631 (1978). Takings claims are evaluated by examining and balancing three factors (1) The economic impact of the regulatory action on the property; (2) the extent to which legitimate property use expectations exist and have been interfered with; and (3) The extent to which the government has used reasonable means to achieve an important public objective. When undertaking this evaluation, the Court must consider the impact on the entire property owner's interest at stake, not just the portion subjected to the regulation.

The State of California seems oblivious to the possibility of the taking of one's property with their attempts for extreme prohibition of not issuing permits or special use permits for suction dredge mining on valid existing mining claims.

United States v Kosanke Sand Corporation
(cite as: 12 IBLA 282)

*288 "It is our conclusion that 'existing law applicable to the agency's operations,' viz., the General Mining Act of 1872, as amended, supra, under which the claims herein involved were located, and which opens to location and purchase, '[e]xcept as otherwise provided, all valuable mineral deposits in lands belonging to the United States, * * * and the lands in which they are found * * *', 30 U.S.C. § 22 (1970), **'makes compliance impossible** "This comports with the position of the Department when it reported in 1971 to the Council on Environmental Quality that the General Mining Act of 1872 do[es] not admit of environmental considerations."

"To the extent that the mining laws give to individuals the right to enter the public domain, to locate claims thereon, to discover minerals therein, and to extract and remove those minerals there from, all without prior approval of the United States, the development of a **mining claim cannot be tortured into 'Federal action,' major, minor or otherwise.**" (emphasis added)

If the United States can not torture a miner into a Federal Action, major, minor or otherwise, what makes State of California believe that they can torture the same Mineral Estate Grantee (miner) **into a Federal or State Action, major minor or otherwise?**

HR 365, Mining Act of 1866, 39th Congress (1866 Mining Law) Sec. 1
"That the mineral lands of the public domain, both surveyed and unsurveyed, are hereby declared to be free and open to exploration and occupation by all citizens of the United States, and those who have declared their intention to become citizens, subject to such regulations as may be prescribed by law, and subject also to the local custom or rules of miners in the several mining districts, so far as the same **may not be in conflict with the laws of the United States**"

INTENT: The intent of the Mining Laws and the continuing intent of Congress is simple and self-evident:

The general policy of the mining laws is to promote widespread

development of mineral deposits and to afford mining opportunities to as many persons as possible. (30 USC 22.50) (emphasis added)

and;

The Congress declares that it is **the continuing policy** of the Federal Government in the national interest **to foster and encourage private enterprise in** (1) the development of economically sound and stable **domestic mining**, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help **assure satisfaction of industrial, security and environmental needs**... For the purpose of this Act 'minerals' shall include all minerals and mineral fuels including oil, gas, coal, oil shale and uranium. (Mining and Minerals Policy Act of 1970) (emphasis added)

RIGHTS TO EXCLUSIVE POSSESSION: Not only is the public domain already the land of whomsoever would desire to occupy the land (due to the grants of 1866 – 1872), which land is now held in trust² for him, but that the right of possession is exclusively his; to hold and enjoy. This possession is clearly guaranteed by the statutes:

So long as the locator complies with statutory requirements and performs assessment work he is **entitled to hold his possession against all the world**, subject to the paramount sovereignty of Suction dredging is a ministerial act or Project in accordance with the California Environmental Quality Act (CEQA), Suction Dredge Mining or prospecting on a federal mining claim is not discretionary as alluded to in the DFG Notice of Preparation (NOP). A miner on a valid mining claim is a private actor.

California Environmental Quality Act (CEQA)

CEQA does not apply to ministerial actions which may impact a historical resource.

For example, a project which complies with the Uniform Building Code and for which no discretionary permit is required does not fall under CEQA, even if the project may alter a building which is considered a "qualified historic structure" under the State Historical Building Code (**Prentiss v. City of South Pasadena (1993) 15 Cal.App.4th 85**).

Common ministerial actions include roof replacement, interior remodeling, or other activities which require only a non-discretionary building permit. A ministerial action applies fixed standards or objective measurements and involves "little or no personal judgment by a public official as to the wisdom or manner of carrying out the project" (*Guidelines* Section 15369).

Significant effect on the environment: Under CEQA, "a significant effect on the environment means a **substantial, or potentially substantial, adverse change** in any of the physical conditions within the area affected by the project including land, air, water,

minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance” (CEQA Guidelines Section 15382).

There has been **no significant or substantial change** in methods used for suction dredge mining since the inception of its permitting by the legislature in 1961. Consequently there is no need for consideration of a law that is prohibitive in nature.

Suction Dredge Mining nor any other form of modern day mining is discretionary and in the case of California’s CEQA suction dredge mining is a ministerial action and can not be classified as discretionary. (CEQ Guidelines 15260 – 15285)

Public Resources Code Section 21080-21098

21080. “ (a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies, including, but not limited to, the enactment and amendment of zoning ordinances, the issuance of zoning variances, the issuance of conditional use permits, and the approval of tentative subdivision maps unless the project is exempt from this division.

(b) This division does not apply to any of the following activities:

- (1) **Ministerial projects** proposed to be carried out or approved by public agencies.
- (2) Emergency repairs to public service facilities necessary to maintain service.
- (3) Projects undertaken, carried out, or approved by a public agency to maintain, repair, restore, demolish, or replace property or facilities damaged or destroyed as a result of a disaster in a disaster-stricken area in which a state of emergency has been proclaimed by the Governor pursuant to Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code.”

Assessment of environmental consequences of state action

Some state statutes require the public agency concerned with the proposed action to consider alternatives to that action; to make a threshold determination as to the effect of the proposal on the environment; and, if the proposal qualifies under the wording of the specific statute, as a commercial development, or a project, action, or major action, significantly affecting the environment, to prepare an environmental impact report or statement in accordance with the procedure outlined in the statute.

Some statutes particularize the factors which must be considered in making an environmental assessment, such as the ability to meet pollution control standards, or the effect of the project on water supplies, or the existing environment, and other statutes provide general guidelines with which the statement or report must comply. While the objectives of a state environmental statute cannot be avoided by dividing a single project

into small pieces which individually have a minimal potential impact on the environment, **no purpose can be served by requiring that the impact statement or report speculate as to environmental consequences of future developments that are unspecified and uncertain.**

The question is: how can the Department of Fish and Game DFG **make an impossible determination of an absolute fact** that the activity is not deleterious when all of the scientific studies are speculative and not conclusive? The law does not allow for the agency or the dredger to comply with the impossible. For your information: An environmental impact report (EIR) must contain facts and analysis, not just the bare conclusions of the agency. Gray v. County of Madera, 167 Cal. App. 4th 1099, 85 Cal. Rptr. 3d 50 (5th Dist. 2008)

Here we see the DFG using that is for most purposes political rather than scientific. It is evident in the scientific study determinations of not being conclusionary but instead are speculative and argumentative among the different studies themselves, the might be, could be, potentially or possibly language. For the scientist to come to a conclusion, yes it is or no it isn't, would dry up their funding and grant money. This can only bring PLP to the conclusion that the use of these studies by the DFG will be a violation the environmental assessment “, **no purpose can be served by requiring that the impact statement or report speculate as to environmental consequences of future developments that are unspecified and uncertain.**”

CUMULATIVE SUPPLEMENT (cases)

Errors in environmental impact report's (EIR's) analysis of the adequacy of mitigation measures to address quarry project's impacts on water, adequacy of mitigation measures with respect to traffic, **cumulative impact on noise levels, and cumulative impacts in general precluded informed decision making** and informed public participation and thus were prejudicial. Gray v. County of Madera, 167 Cal. App. 4th 1099, 85 Cal. Rptr. 3d 50 (5th Dist. 2008).

An environmental impact report (EIR) must contain facts and analysis, not just the bare conclusions of the agency. Gray v. County of Madera, 167 Cal. App. 4th 1099, 85 Cal. Rptr. 3d 50 (5th Dist. 2008).

Notwithstanding the exemption from some chapters of California Environmental Quality Act (CEQA), the timber harvesting plan (THP) preparation and approval process is the functional equivalent of the preparation of an environmental impact report (EIR) contemplated by CEQA. West's Ann.Cal.Pub.Res.Code §§ 4511 et seq., 21000 et seq. Ebbetts Pass Forest Watch v. California Dept. of Forestry and Fire Protection, 43 Cal. Rptr. 3d 363 (Cal. App. 5th Dist. 2006), as modified on denial of reh'g, (May 15, 2006) and review granted and opinion superseded, (July 19, 2006).

In order to determine whether a project has a significant effect on the environment, it is **necessary to consider the impact of the total project** rather than a single aspect of the project. Juanita Bay Valley Community Ass'n v. City of Kirkland, 9 Wash. App. 59, 510 P.2d 1140, 5 Env't. Rep. Cas. (BNA) 1769 (Div. 1 1973)

[FN53] Russian Hill Improvement Assn. v. Board of Permit Appeals, 44 Cal. App. 3d 158, 118 Cal. Rptr. 490 (1st Dist. 1974), appeal dismissed, 422 U.S. 1030, 95 S. Ct. 2646, 45 L. Ed. 2d 687 (1975) (applying a statute requiring the environmental impact report to set forth in writing (1) the environmental impact of the proposed action, (2) any adverse environmental effects which cannot be avoided if the proposal is implemented, (3) **mitigation measures to minimize the impact, (4) alternatives to the proposal, (5) the relationship between local and short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (6) any irreversible environmental changes which would be involved should the proposed action be implemented); Eastlake Community Council v. Roanoke Associates, Inc., 82 Wash. 2d 475, 513 P.2d 36, 5 Env't. Rep. Cas. (BNA) 1897, 3 Env'tl. L. Rep. 20867, 76 A.L.R.3d 360 (1973)**

To a fault the scientific studies address any effects from suction dredging mining are local and short term environmental effects and **there is no evidence in any of the studies addressing irreversible changes to the environment**. The EIR needs to address the fact that there are no known long term impacts from suction dredge mining and take this under consideration in the rule making process.

In Minnesota Public Interest Research Group v. Minnesota Environmental Quality Council, 306 Minn. 370, 237 N.W.2d 375 (1975), the court affirmed a lower court ruling that the construction of an exploratory copper-nickel mine shaft by an exploration company was a private action of only local significance which did not require an environmental impact report. It found the project to be distinguishable from the actual copper-nickel mining.

[FN55] Lake County Energy Council v. County of Lake, 70 Cal. App. 3d 851, 139 Cal. Rptr. 176, 7 Env'tl. L. Rep. 20699 (1st Dist. 1977) (while there is no requirement that the report engage in sheer speculation as to future environmental consequences, if the agency preparing the report has fairly reliable information about prospective developments, such information should be given, even though there is no right of control over such secondary effect).\

Again we discuss the fact that **a mining activity is a private actor** and again there is only a local and short term consequence and for the DFG to speculate on future environmental consequence is unnecessary and unwarranted and cannot be used to come to a negative conclusion on suction dredge mining.

California will not be significantly affected. That is manifestly untrue. In fact, this CEQA study will certainly have a significant affect on California's Mineral Recourses, and by CEQA guidelines, **"Mineral Resource" must be included**. If not, this CEQA study is fatally flawed from the beginning.

Public Resources Code, Section 21002.1 (a) states that:

"The purpose of an environmental impact report is to identify the significant effects of a project on the environment, to identify alternatives to the project, and to indicate the manner in which those significant effects can be mitigated or avoided."

If potential environmental impacts are identified, the agency is then **required to analyze what is necessary to mitigate** them and or select feasible alternatives.

With regard to "suction dredge gold mining", within unpatented mining claims, there are no feasible **"alternatives", other than temporary seasonal , or permanent closures**. **Both would effect regulatory "takings"** of private property interests held by all affected unpatented mining claim owners. Any seasonal restriction (where unpatented mining claim are situated), "is a temporary" "taking" *Ventura County v. Gulf Oil Corporation*, 601 F.2d 1090 (1979).

Generally, "economic impacts" need not be included within a "CEQA" study. As economic impacts are not potential, or actual physical changes to the environment. Here however, **when temporary, or permanent closures** of given area's are utilized to "mitigate" or "avoid" significant effects to the environment attributed to suction dredging, economic impact is relevant to measure the significance of an environmental impact.

Any purported CEQA study that utilizes a "one size fits all" methodology is therefore fundamentally flawed.

Title 14. California Code of Regulations

Chapter 3. Guidelines for Implementation of the California Environmental Quality Act

Article 19. Categorical Exemptions

15300. Categorical Exemptions

Section 21084 of the Public Resources Code requires these Guidelines to include a list of classes of projects which have been determined not to have a significant effect on the environment and which shall, therefore, be exempt from the provisions of CEQA. In response to that mandate, the Secretary for Resources has found that the following classes of projects listed in this article do not have a significant effect on the environment, and

they are declared to be categorically exempt from the requirement for the preparation of environmental documents. Note: Authority cited: Section 21083, Public Resources Code; Reference: Section 21084, Public Resources Code.

15300.1. Relation to Ministerial Projects

Section 21080 of the Public Resources Code exempts from the application of CEQA those projects over which public agencies exercise only ministerial authority. Since ministerial projects are already exempt, categorical exemptions should be applied only where a project is not ministerial under a public agency's statutes and ordinances.

CA DF&G themselves held that issuance of a dredging permits, is MINISTERIAL

15304. Minor Alterations to Land

Class 4 consists of minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees except for forestry or agricultural purposes. Suction dredge fits inside this exemption.

15330. Minor Actions to Prevent, Minimize, Stabilize, Mitigate or Eliminate the Release or Threat of Release of Hazardous Waste or Hazardous Substances.

Class 30 consists of any minor cleanup actions taken to prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release of a hazardous waste or substance which are **small or medium removal actions costing \$1 million or less**. Suction dredging fits here also, as it certainly removes toxic mercury & lead

The U.S. Supreme Court has unequivocally determined "unpatented mining claims" are private property, subject to Constitutional protection from "taking", without compensation. **Given that fact, this CEQA study must include an economic analysis**, on its effects, as they pertain to "suction dredge gold mining" on mining claims. In-so-far as this CEQA study result take's" hundreds of millions, if not a billions of dollars in compensable private property rights belonging to affected mining claim owners.

"This Constitution and the laws of the United States which shall be made in pursuance thereof...shall be the supreme law of the land; and the judges in every state shall be bound thereby, anything in the Constitution or laws of any state to the contrary notwithstanding." Supremacy Clause, Article VI U.S. Constitution

The General Mining Law of 1872, is a clear unequivocal federal grant towards disposal of federal public domain lands, containing valuable minerals, open to such entry.

Absolutely guaranteeing the grantee's the right to mine applicable valuable minerals they own, under reasonable regulation.

The legislature of California accepted this express provision in 1850, thus as long as the

Federal government retains title, the federal interest in providing free access to its own land in order to promote **mining is sufficient to preempt any state law that fundamentally bans such use**. Accordingly under standard preemption analysis any state legislation, or subsequent regulation that conflicts with this overriding federal purpose, must fail.

The purpose of the Mining Act is to encourage mining on federal lands. *United States v. Weiss*, 642 F.2d 296, 299 (9th Cir.1981) (Weiss); see also *United States v. Goldfield Deep Mines Co.*, 644 F.2d 1307, 1309 (9th Cir.1981), cert. denied, 455 U.S. 907, 102 S.Ct. 1252, 71 L.Ed.2d 445 (1982).

Unpatented mining claims are **self-initiated rights granted** under the General Mining Law. Congress exercised that discretion in granting those rights under the law. (30 U.S.C.A. § 23, 27-28; 43 U.S.C.A. § 1744; *Cole v. Ralph*, 252 U.S. 286, 296 (1920).)

In law, the word "claim" in connection with the phrase "mining claim" represents a federally recognized right in real property. The Supreme Court has established that a mining "claim" is not a claim in the ordinary sense of the word—a mere assertion of a right—but rather is a property interest, which is itself real property in every sense, and not merely an assertion of a right to property. ***Benson Mining & Smelting Co. v. Alta Mining & Smelting Co.*, 145 U.S.428 (1892)**

Locators' rights of possession and enjoyment. The locators of all mining locations ... situated on the public domain, their heirs and assigns, ... so long as they comply with the laws of the United States, and with **State, territorial, and local regulations not in conflict with the laws of the United States** governing their possessory title, shall have the exclusive right of possession and enjoyment of all the surface included within the lines of their locations". (for mining purposes)30 USC § 26.

Valid unpatented mining claims are "**property in the fullest sense of that term.**" (*Wilbur v. United States ex rel. Krushnic*, 280 U.S. 306, 316 (1930).) Which entitles the owner "the right to extract all minerals from the claim without paying royalties to the United States." *Swanson v. Babbitt*, 3 F.3d 1348. Further entitling the holder to "the right to a flow of income from production of the claim." (*United States v. Locke*, 471 U.S. 84, 104 - 105 (1985).)

Even though title to the fee estate remains in the United States, these unpatented mining claims are themselves **property protected by the Fifth Amendment against uncompensated takings**. See *Best v. Humboldt Placer Mining Co.*, 371 U.S. 334 (1963); cf. *Forbes v. Gracey*, 94 U.S. 762, 766 (1876); U.S.C.A.Const. Amend. 5; *North American Transportation & Trading Co. v. U.S.*, 1918, 53 Ct.Cl. 424, affirmed 40 S.Ct. 518, 253 U.S. 330; *United States v. Locke*, 471 U.S. 84, 107, 105 S.Ct. 1785, 1799, 85

L.Ed. 2d 64 (1985); *Freese v. United States*, 639 F.2d 754, 757, 226 Ct.Cl. 252, cert. denied, 454 U.S. 827, 102 S.Ct. 119, 70 L.Ed. 2d 103 (1981); *Rybachek v. United States*, 23 Cl.Ct. 222 (1991).

Water Rights

California law recognizes water rights by ownership of riparian land, appropriation, or prescription. Cal. Water Code § 2501. In *re Water of Hallett Creek Stream Sys.*, 749 P.2d 324 (Cal. 1988), cert. denied sub nom. *California v. United States*, 488 U.S. 824 (1988). The California Supreme Court ruled that the federal government, as owner of nearly half the land in the state, held riparian water rights on the **lands it set aside for particular federal purposes**, but that the extent of rights were determined with reference to the interests of other water users. *Id.* at 327.

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What becomes plain to anyone knowledgeable in the area of federal lands, and mining law, in reading, and trying to respond to this initial study report. Is that DFG themselves & the company that they contracted to compile, and perform the EIR, lack a basic understanding of fundamental law, and facts governing federal public domain & mining on it.

FACT 1. The vast majority of all suction dredge gold mining in California takes place on federal public domain lands.

FACT 2. The vast majority of those same federal lands, are open to mineral entry under federal mining laws & where gold exists are held under mining claims.

FACT 3. Mining on federal lands, is encouraged by federal policy directive & governed by federal law & regulation.

FACT 4. Once a valid mining claim is established, it grants the owner various protected private property rights.

FACT 5. State law, and regulation cannot prohibit what federal law encourages, and allows.

What we have here is a state agency who's primary responsibility is to regulate California's fish & game as follows:

DFG CODE Section 200

200. There is hereby delegated to the commission the power to regulate the taking or possession of birds, mammals, fish, amphibia, and reptiles to the extent and in the manner prescribed in this article.

201. Nothing in this article confers upon the commission any power to regulate any natural resources or commercial or other activity connected therewith, except as specifically provided.

DFG Section 201 provisions creates a conundrum, because valuable minerals are a “natural resource”, and mining is both “commercial” & “activity” connected to it.

Written Notice Required

DFG has no statutory authority over “mineral resources” within California. No one can rationally refute that ‘mining claims’ involve ‘mineral resources’, and their extraction. No one can credibly refute the majority of all suction dredge gold mining in California takes place on mining claims.

A CEQA process is neither legitimate, or legal.
If the property owners are not given timely legal “notice” of the “project”, involving their property.

The state of California by passage of SB 670 mandated the issuance of small scale suction dredge gold mining permits is a “project” subject to CEQA requirements. In doing so, the state of California automatically made all active suction dredge gold mining permit holders “proponents” of this CEQA “project”.

However, **DFG did not give written “Notice” to all affected individual mining claim owners in California**, SB 670 automatically made “project proponents”. The CEQA process is normally triggered by a person, entity or agency applying for a “permit” to do something that may have a significant adverse effect on California’s environment. If that is found to be the case, and the proposed project is not covered by any CEQA “exemptions”. The CEQA process is triggered, and proceeds.

That whole CEQA body of law, regulation, and agenda is based on the premise, that a person, or entity having made an application for a permit, certainly has knowledge, and constructive notice of the process, as the applicant, or applicants themselves initiated it.

In this case, that is absolutely not so. Because all prospective applicants (**i., e., all mining claim owners in California**) who’s private property rights will certainly be profoundly affected by this CEQA project, neither have, or were given “notice” of them being arbitrarily placed in the position of CEQA project applicants, or proponents.

In effect, what we have here is an adjudicative land use decision process, without the land, or property rights owners (i., e., mining claim owners) being legally informed, or given actual notice of the adjudication of crucial matters intensely affecting each of them, and all of their individual private property rights combined. **This alone violates the Browns Act**

Under those factual conditions, without actual notice to all effected fee simple property and mining claim owners, the whole of the CEQA, APA process is fundamentally flawed from the beginning. For instance, DFG scheduled three public “scoping” meetings the 16th, 17th & 18th of November, 2009, so that involved parties could submit questions, and or comments on the process. Written comments on the process will not be entertained, if not submitted by December 3, 2009.

The fact that DFG gave **no actual written notice to all affected patented, or unpatented “mining claim owners”**, statewide throughout California. Them lacking such notice of the process, scoping meetings, and comment submission deadline periods compounds the critical flaws being made here, one after the other by the state of California, and the lead agency (DFG).

These critical administrative and procedural errors here, one after another, fatally “taint” the complete CEQA process regarding small scale suction dredge gold mining permits. To the degree each error, or cumulative multiple errors make the process more, and more subject to a whole series of “judicial” challenges. One, any, or all of which will certainly be brought by affected parties, in order to protect their private property rights.

Anyone thinking that all mining claim owners in California will stand idly by, doing nothing, while the state perpetrates an illegal regulatory “taking” of their property. Which **deprives the owners of all of their property's utility and value**. Unlawfully denying them of every benefit of the private property they own. Here, the California legislature, and DFG is grossly mistaken, as doing so is a constitutionally forbidden de facto taking without compensation. Which mining claim owners throughout California will never allow.

**CEQA § 21082.2. SIGNIFICANT EFFECT ON ENVIRONMENT;
DETERMINATION;
ENVIRONMENTAL IMPACT REPORT PREPARATION**

(a) The lead agency shall determine whether a project may have a significant effect on the environment based on substantial evidence in light of the whole record.

(b) The existence of public controversy over the environmental effects of a project shall not require preparation of an environmental impact report if there is no substantial evidence in light of the whole record before the lead agency that the project may have a significant effect on the environment.

(c) Argument, speculation, unsubstantiated opinion or narrative, evidence which is clearly inaccurate or erroneous, or evidence of social or economic impacts which do not contribute to, or are not caused by, physical impacts on the environment, is not substantial evidence. Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts.

(d) If there is substantial evidence, in light of the whole record before the lead agency, that a project may have a significant effect on the environment, an environmental impact report shall be prepared.

(e) Statements in an environmental impact report and comments with respect to an environmental impact report shall not be deemed determinative of whether the project may have a significant effect on the environment.

CEQA requires that decisions be informed and balanced. It must not be subverted into an instrument for the oppression and delay of social, economic, or recreational development or advancement. (*Laurel Heights Improvement Assoc. v. Regents of U.C.* (1993) 6 Cal.4th 1112 and *Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553)

The purpose of CEQA is not to generate paper, but to compel government at all levels to make decisions with environmental consequences in mind. (*Bozung v. LAFCO* (1975) 13 Cal.3d 263).

The lead agency must consider the whole of an action, not simply its constituent parts, when determining whether it will have a significant environmental effect. (*Citizens Assoc. For Sensible Development of Bishop Area v. County of Inyo* (1985) 172 Cal.App.3d 151)

15384. SUBSTANTIAL EVIDENCE

(a) "Substantial evidence" as used in these guidelines means enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached. Whether a fair argument can be made that the project may have a significant effect on the environment is to be determined by examining the whole record before the lead agency. Argument, speculation, unsubstantiated opinion or narrative, evidence which is

clearly erroneous or inaccurate, or evidence of social or economic impacts which do not contribute to or are not caused by physical impacts on the environment does not constitute substantial evidence.

(b) Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts.

§ 21166. SUBSEQUENT OR SUPPLEMENTAL IMPACT REPORT; CONDITIONS

When an environmental impact report has been prepared for a project pursuant to this division, no subsequent or supplemental environmental impact report shall be required by the lead agency or by any responsible agency, unless one or more of the following events occurs:

(a) Substantial changes are proposed in the project which will require major revisions of the environmental impact report.

(b) Substantial changes occur with respect to the circumstances under which the project is being undertaken which will require major revisions in the environmental impact report.

There have not been any substantial changes in the methods or operations of suction dredge mining nor has there been any substantial changes in the scientific studies that address the effects of suction dredge mining.

(c) New information, which was not known and could not have been known at the time the environmental impact report was certified as complete, becomes available.

PLP must ask the DFG to bring forth the new information that has been brought forth to show new environmental impacts related to suction dredge mining since the 1994 EIR? Otherwise DFG must be violation of above code.

3.3.15 Mineral Resources

Introduction

The purpose of the “**Mineral Resources**” section is to identify and evaluate the potential for the project to **adversely affect the availability of known mineral resources**. The mineral resources of concern include metals, industrial minerals (e.g., aggregate, sand and gravel), oil and gas, and geothermal resources that would be of value to the region and residents of the State.

EIR

The mineral resources impact analysis should focus on the **potential loss of availability of the mineral resource due to land use conversions**. Loss of access to mineral

resources would primarily be the result of conversion of lands underlain by these resources to other uses, or within close proximity to the resources, such that the construction and occupancy of the project would restrict or eliminate safe and environmentally sound measures to implement extractive operations. **Loss of access could also be the result of changes in land ownership** (e.g., non-renewal of a lease where active mining is occurring). Loss of access to mineral resources for the purposes of future extraction could be considered to be primarily an economic issue. According to CEQA Guidelines Section 15131(a)

Standards of Significance

Would the project; Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?

Result in the loss of availability of a locally-important **“mineral resource”** recovery site delineated on a local general plan, specific plan, or other land use plan?

3.3.15-3

Yet, to comply with the Mining Laws the DFG will most certainly have to allow the miner to do individual mitigation in many circumstances for special uses. This is of course something the DFG seems completely oblivious to since they believe that they have discretion to deny, which of course they do not.

The only locatable mineral on the majority of unpatented placer claims held under federal law is placer gold, which is naturally concentrated in stream or river bed gravels, and usually nowhere else in worthwhile amounts. The only economically viable means to profitably recover placer gold in stream or river gravel is by “suction dredge mining”.

Accordingly, suction dredging is the **“Highest & Best Use”** of river placer mining claims. As a matter of fact, it is only viable use, as no other mining method is practical, economical, profitable or environmentally sound.

When the only viable use of an unpatented placer mining claim is by suction dredging, arbitrarily prohibiting that use (even temporarily) effects a complete “taking” of all economic benefit the owner could derive from it, for the duration of the ban.

The **Fifth Amendment to the United States Constitution**, made applicable to state and local governments by the Fourteenth Amendment, prohibits the government from taking private property for public use without just compensation.

The California Constitution provides, "Private property may be taken or damaged for public use only when just compensation ... has first been paid to, or into court for, the owner." (Cal. Const., art. I, § 19.)

It is well established that just compensation... is the full value of the property taken at the time of the taking, plus interest from the date of taking. *United States v. Blankinship*, 9 Cir., 1976, 543 F.2d 1272, 1275.

Without doubt, S.B. 670 capriciously deprives thousands of families of their legitimate livelihood, and caused an immediate gross compensatory "taking" of valid existing rights, and compensable private property interests of considerable magnitude.

California Liability

The Treasury of the State of California will ultimately be held liable to pay compensable damages to all those effected, accruing from August 6th 2009 forward. Until at least the illegal ban on suction dredging unpatented placer mining claims is lifted, or if necessary overturned by appropriate federal court action.

Federal mining claims are "**private property**" *Freese v. United States*, 639 F.2d 754, 757, 226 Ct.Cl. 252 cert. denied, 454 U.S. 827, 102 S.Ct. 119, 70 L.Ed.2d 103 (1981); *Oil Shale Corp. v. Morton*, 370 F.Supp. 108, 124 (D.Colo. 1973).

This **possessory interest** entitles the claimant to "the right to extract all minerals from the claim without paying royalties to the United States." *Swanson v. Babbitt*, 3 F.3d 1348, 1350 (9th Cir. 1993).

16 U.S.C. § 481, Use of Waters: **All waters within boundaries of national forests may be used for domestic, mining, milling, or irrigation purposes under the laws of the state wherein such national forests are situated or under the laws of the United States and the rules and regulations established thereunder.**

"Uncompensated divestment" of a valid unpatented mining claim would **violate the Constitution**. *Freese v. United States*, 639 F.2d 754, 757, 226 Ct.Cl. 252, cert. denied, 454 U.S. 827, 102 S.Ct. 119, 70 L.Ed. 2d 103 (1981).

Even though title to the fee estate remains in the United States, these unpatented mining claims are themselves **property protected by the Fifth Amendment** against uncompensated takings. See *Best v. Humboldt Placer Mining Co.*, 371 U.S. 334 (1963); cf. *Forbes v. Gracey*, 94 U.S. 762, 766 (1876); U.S.C.A.Const. Amend. 5; *North American Transportation & Trading Co. v. U.S.*, 1918, 53 Ct.Cl. 424, affirmed 40 S.Ct. 518, 253 U.S. 330; *United States v. Locke*, 471 U.S. 84, 107, 105 S.Ct. 1785, 1799, 85

L.Ed. 2d 64 (1985); Freese v. United States, 639 F.2d 754, 757, 226 Ct.Cl. 252, cert. denied, 454 U.S. 827, 102 S.Ct. 119, 70 L.Ed. 2d 103 (1981); Rybachek v. United States, 23 Cl.Ct. 222 (1991).

A valid location, though unpatented, is a grant in the nature of an estate in fee and if such an estate is taken by the United States, **just compensation must be made**. See U.S.C.A. Const. Amend. 5, North American Transportation & Trading Co. v. U.S., 1918, 53 Ct.Cl. 424, affirmed 40 S.Ct. 518, 253 U.S. 330

Such an interest may be asserted against the United States as well as against third parties (see Best v. Humboldt Placer Mining Co., 371 U.S. 334, 336 (1963); Gwillim v. Donnellan, 115 U.S. 45, 50 (1885)) **and may not be taken from the claimant by the United States without due compensation**. See United States v. North American Transportation & Trading Co., 253 U.S. 330 (1920); cf. Best v. Humboldt Placer Mining Co.

However, showing potential for harm, and showing that actual harm exists are two different things, and the studies to date have not shown any actual effect on the environment by suction dredging except for those that are short-term and localized in nature.

Current regulatory efforts are proceeding despite this lack of evidence showing that harm to the environment is taking place. The regulatory agencies should be consistently and continually challenged by the dredging community to produce sound, scientific evidence that support their proposed regulations. **To regulate against a "potential for harm", where none has been shown to exist, is unjustifiable and must be challenged.**
State, Legislators and DFG Errors

The state courts fumbling the matter, ignoring the private property rights, unpatented mining claim owners do have.

The CA F&G doing flip flips whether or not the issuance of suction dredge permits is "ministerial" or not. Meaning, they either have no discretion, and must issue them, or discretion to not issue them.

The legislature finding SB 670 has no or negligible economic impact. When in fact the economic impact toll may reach \$100 million dollars annually.

The legislature passing SB 670, premised on "findings" that will be made at some future date, which is laughable.

The legislature passing SB 670, as emergency legislation, where no emergency exists, which is unconscionable.

Public hearings going on, the results of which will certainly effect the private property rights of as many as 60,000 individual owners of unpatented mining claims in California, without any notice to them.

A state agency that has very little expertise in what it regulates, hiring a private firm, that clearly has no expertise in much of what it is being paid \$1.5 million dollars to do.

A “temporary” ban on all suction dredge gold mining in California, that is “indefinite”.

Private property being illegally taken, without just compensation being paid.
Not from one, but thousands of mining claim owners.

All in all here, we have an ever expanding comedy of bureaucratic bumbling.
The end of which is not yet in sight. Apparently, this is a perfect example of California “governance” at it’s finest.

What becomes plain to anyone knowledgeable in the area of federal lands, and mining law, in reading, and trying to respond to this initial study report. Is that DFG themselves & the company that they contracted to compile, and perform the EIR, lack a basic understanding of fundamental law, and facts governing federal public domain & mining on it. In so far as the right to mine, on federal lands, on unpatented mining claims, is a federally protected private property right. Public Lands for People, et., al., immediately filed a lawsuit against the state of California, against numerous unlawful provisions of SB 670.

In the same span of time, CA DFG spends \$1.5 million dollars hiring a ““water quality”” evaluation firm, to commence the state wide CEQA study. The firm presents CA DFG with an “Initial Study” report that is fundamentally flawed, because neither CA DFG or the firm have expertise, nor experience with federal land law, federal mining law, and associated private property rights conferred to owners of unpatented mining claims, where the vast majority of suction dredge gold mining takes place in California.

Notice of Preparation / Initial Study
Project No. 09.005

The environmental factors checked below would potentially be affected by this project (i.e., the project would involve at least one impact that is a “Potentially Significant Impact”), as indicated by the checklist on the following pages.

CHECK LIST

Aesthetics (checked)
Air Quality (checked)
Biological Resources (checked)
Cultural Resources (checked)
Hazards and Hazardous Materials (checked)
Hydrology/Water Quality (checked)
Noise (checked)
Recreation (checked)
Mandatory Findings of Significance (checked)
Mineral Resources (NOT CHECKED)
Signed, John McCamman, Chief Deputy Director 10/26/09

The Chief Deputy Director of DFG has made a knowingly deliberate, and utterly false official written statement here, by not checking the **“Mineral Resource”** checklist box in this official CEQA initial study report. The consequence, of which might not seem readily apparent, nor even significant. However, I assure you, it is strikingly significant in several differing aspects involved here.

It is common knowledge, and utterly indisputable that gold, platinum, and other associated extremely valuable minerals are certainly **“Mineral Resources”**.

It is common knowledge, and utterly indisputable that these valuable **“mineral resources”** certainly exist as placer deposits, within waterways throughout California.

It is common knowledge, and utterly indisputable that “suction dredging” is a widespread modern efficient small scale mining method throughout California. Clearly, that is what triggered this CEQA study.

It is common knowledge, and utterly indisputable that small scale suction dredging is usually profitable. Otherwise, no prudent person would invest in a suction dredge, nor spend time performing arduous labor to do it and especially now with gold at over \$1100 per ounce.

It is common knowledge, and utterly indisputable that relatively significant amounts of gold, and other valuable minerals are recovered by small scale suction dredging annually in California.

Given this indisputable series of facts. It is not possible by any stretch of imagination, or reality. That the Chief Deputy Director of CDFG, the very state agency that regulates all

suction dredge permitting statewide throughout California, could assert small scale “suction dredging” does not involve, nor have a potentially significant impact on “Mineral Resources” within California.

Doing so, clearly and profoundly impugns the Chief Deputy Directors professional credibility, as well as destroys the reliability and total integrity of the very CEQA study, he now directs. Why the head of public agency would make a deliberate false statement in an official state document, is by itself incredulous. So, giving him the benefit of doubt, that is sane, there must be some other devious factor behind him doing it.

The CEQA provisions impart are:

California Environmental Quality Act (CEQA) Guidelines Appendix G states that a project would have a significant impact on mineral resources if it would:

- a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.
- b. Result in the loss of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

Which would be arbitrary, capricious, an abuse of discretion or otherwise not in accordance with law, any way it might appear in CEQA documents.

If any public funds are expended, for costs involved in public meetings, or any proceeding, or study, that is not based on sound legal footing, and at any later date, any such meeting, proceeding or study is required by law to be repeated in full conformity with all applicable law. Duplicate spending to cover what should have been done right, the first time, is a total waste. For which someone must be held responsible.

Given the obvious conundrum there, the issue is then further complicated by the California legislature, without an Attorney Generals legal opinion, whether or not SB 670 is legal. The legislature pass's SB 670, which prohibits all suction dredging state wide until both state court orders are complied with, a state wide CEQA study is performed, and any new suction dredging regulations, if needed, are implemented.

In so far as the right to mine, on federal lands, on unpatented mining claims, is a federally protected private property right. Public Lands for People, et., al., immediately filed a lawsuit against the state of California, against numerous unlawful provisions of SB 670.

The Administrative Procedure Act (APA) establishes rulemaking procedures and standards for state agencies in California. The requirements set forth in the APA are designed to provide the public with a meaningful opportunity to participate in the adoption of state regulations and to ensure that regulations are clear, necessary and legally valid. The APA is found in the California Government Code, section 11340 et seq. State regulations must also be adopted in compliance with regulations adopted by OAL (see California Code of Regulations, Title 1, sections 1-280).

11342.510. Unless the provision or context otherwise requires, the definitions in this article govern the construction of this chapter. 11342.520. "Agency" means state agency.

11342.535. "Cost impact" means the amount of reasonable range of direct costs, or a description of the type and extent of direct costs, that a representative private person or business necessarily incurs in reasonable compliance with the proposed action.

11342.580. "Plain English" means language that satisfies the standard of clarity provided in Section 11349.

Regulatory Notice Register.

11342.600. "Regulation" means every rule, regulation, order, or standard of general application or the amendment, supplement, or revision of any rule, regulation, order, or standard adopted by any state agency to implement, interpret, or make specific the law enforced or administered by it, or to govern its procedure.

11342.610. (a) "Small business" means a business activity in agriculture, general construction, special trade construction, retail trade, wholesale trade, services, transportation and warehousing, manufacturing, generation and transmission of electric power, or a health care facility, unless excluded in subdivision (b), that is both of the following:

- (1) Independently owned and operated.
- (2) Not dominant in its field of operation.

CONCLUSIONS

In this document, we have shown how the Mineral Estate Grantees have clear and distinct rights unlike any other user of the public lands. We have shown how the **Mineral Estate Grantees have "Real Property"** under the highest sense of such terms. We have shown how the State of California's attempt to prohibit instead of to regulate suction dredge mining is based on totally flawed or unsound "science" (and we use that term loosely –

there is no “science”). We have shown how The State of California has no authority to supersede Federal Law. We have shown how mining activities under the U.S. Mining Acts are “non-discretionary” activities, and as such do not fall under the purview of the ESA, or for that matter the CWA, or even NEPA, or CEQA. We have shown how the proposed prohibition will constitute a “taking” of the Mineral Estate Grantees Property, and lastly, we have shown how it is the continuing intent of the U.S. Congress to “foster and encourage” mineral development. This whole thing could have been avoided by the state of California if they had just attempted, in good faith, to work within the law and work with the miners to come up with some reasonable regulations. For well over 4 years the negotiations, court cases and legislative Bills have been going on and the miners and prospectors are well aware that the process is coming to an end. This is the last chance for their plea’s to be heard by the State of California. The Departmental Bureaucracy has worn all of the participants down to a point where patience is thin . . . but this does not mean the State of California has the final word, yet.

The Mineral Estate Grantee’s and prospectors are still positive in their position, still looking to make the American System work as it should. They have rights granted to them, and up to this point, those rights have been violated because the American System is failing because of violations of the law by the State of California. There is still one more step in the process to insure that the American System will work for the people.

Suction dredge gold mining is the only practical, economical and environmentally sound method to recover small scale placer gold deposits in rivers and gravels within California.

If a state agency is unable, fails to, or ignores “reality”, they clearly lack a basis of sound judgment to formulate practical, suitable, and fair regulation of anything. As resulting regulations could, and likely would be impractical, leading to confusion, consternation, and protracted costly litigation to clarify such arbitrary, or capricious regulation. None of which is in the regulating agency, or public’s best interest.

PLP and their members and member organizations feel compelled to put the State of California on notice that we must be guided back in the right direction or be responsible for the real possibility of imminent harm and Takings Claims under the 5th and 14th Amendments to the U.S. Constitution, violations of California State Laws and violations Federal Law on the this issue.

RECOMMENDATIONS: We strongly suggest that in order for the State of California and the Agencies to avoid many costly takings lawsuits that they discard the proposed prohibitions, go back to “good faith” meetings with the miners and

using good sound verifiable science draft regulations that protect the environment as much as possible without materially hindering or interfering with the lawful mining activities of the Mineral Estate Grantees.

Notice is given

I hereby officially request DFG's unlawful actions cease and desist immediately. Failure to do so could subject the Director to personal suit for damages and those individuals acting in concert. The Director may also be subject to prosecution by the Dept. of Justice for Violations of the Hobbs Act (18 U.S.C. 1951), which states in part:

"(a) Whoever in any way or degree obstructs, delays, or affects commerce or the movement of any article or commodity in commerce, by robbery or extortion or attempts or conspires so to do, or commits or threatens physical violence to any person or property in furtherance of a plan or purpose to do anything in violation of this section shall be fined under this title or imprisoned not more than twenty years, or both.

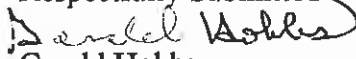
(b) As used in this section--

(1) The term "robbery" means the unlawful taking or obtaining of personal property from the person or in the presence of another, against his will, by means of actual or threatened force, or violence, or fear of injury, immediate or future, to his person or property, or property in his custody or possession, or the person or property of a relative or member of his family or of anyone in his company at the time of the taking or obtaining.

(2) The term "extortion" means the obtaining of property from another, with his consent, induced by wrongful use of actual or threatened force, violence, or fear, or under color of official right." Emphasis added

(3) Makes or uses any false writing or document knowing the same to contain any materially false, fictitious, or fraudulent statement or entry; shall be fined under this title, or imprisoned for not more than 5 years.

Respectfully Submitted


Gerald Hobbs
President PLP



**Effects of Recreational Suction Dredge
Operations on Fish and Fish Habitat:
A Literature Review in Association with a
Petition of the Idaho Gold Prospectors
Association to the Idaho Land Board**

**Final Report - 1996
Konopacky Project No. 064-0**

**Prepared for:
Idaho Gold Prospectors Association
Boise, Idaho 83709**

**Prepared by:
Konopacky Environmental
Meridian, Idaho 83642-6238**

July 9, 1996

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3044 East Autumn Way
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July 9, 1996

2.0 STUDY AREA

2.1 Location of Streams/Rivers in Reviewed Literature

Relative to the reviewed publications and other literature for this report, the study area included all streams and rivers noted in reports that addressed the effects of recreational mining on fish and/or fish habitat. Most, if not all, streams noted in the literature reviewed for this report contained one or more salmonid species.

2.2 Location of IGPA-Petitioned Reach of the Boise River

Per the most recent petition of the IGPA (1996), the reach requested for entry is the approximately 27.7 contiguous miles of the Boise River and Middle Fork of the Boise River upstream of Arrowrock Dam reservoir (Figure 1). The confluence of Middle and North forks of the Boise River form the Boise River proper.

Fish species present in the above-noted reach of the Boise River system include rainbow/redband trout *Oncorhynchus mykiss*, cutthroat trout *O. clarki*, bull trout *Salvelinus confluentus*, brook trout *S. fontinalis*, and mountain whitefish *Prosopium williamsoni* (Idaho Department of Fish and Game, pers. comm., June 20, 1996). The bull trout is presently a candidate for listing as a federal endangered species.

Two types of fishing regulations occur in the 27.7-mile long reach of the Boise River requested for entry by the IGPA (Idaho Department of Fish and Game 1996). General fishing regulations are in effect from Arrowrock Dam, including the reservoir, to the confluence of the North and Middle Forks of the Boise River (Figure 1). General regulations for the reach include being open to some form of fishing all year, except for April and part of May, and daily bag limits of up to sixteen trout (e.g., six rainbow trout and ten brook trout), fifty whitefish, and no bull trout. Special or more restrictive fishing regulations are in effect from the confluence of the North and Middle Forks of the Boise River to the upstream end of the above-noted 27.7-mile reach of river. Special regulations include a daily bag limit of two trout, in aggregate (i.e., all species of trout and salmon present), neither of which may be less than fourteen inches long, fifty whitefish, and no bull trout. Only artificial flies and lures with one barbless hook per fly or lure may be used in the reach (i.e., no bait). Trout season runs from the May 25 through November 30 during 1996 while the whitefish seasons runs from January 1 through March 31 and from May 25 through December 31 during 1996. Seasons vary on a bi-yearly basis.

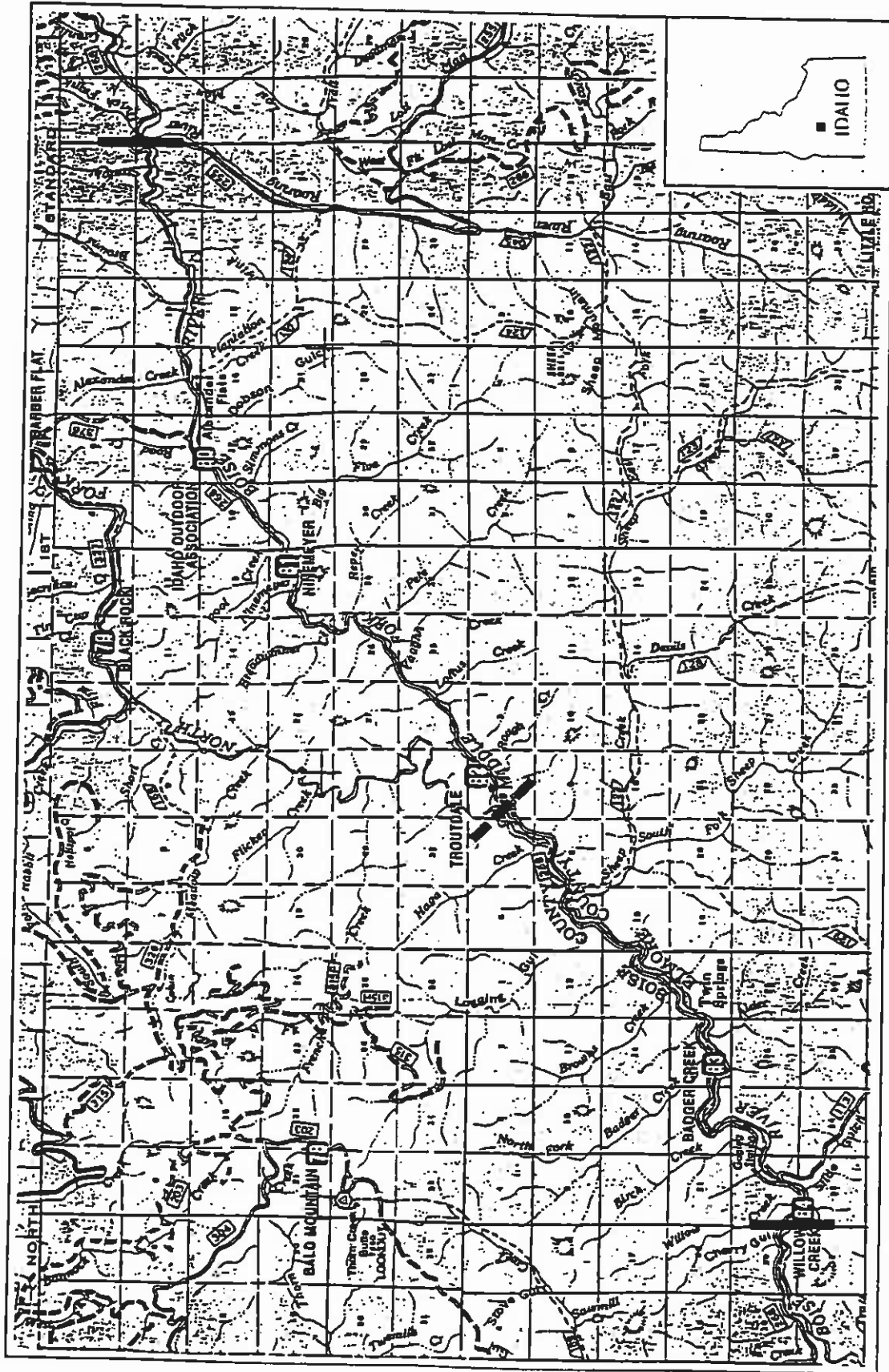


Figure 1. Location of 27.7-mile reach of the Boise River petitioned for mineral entry by the IGPA. Dotted line at the confluence of the North-Middle forks connotes the location of the change from general (upstream) to restricted (downstream) fishing regulations. In diameter. Scale: 1 inch=approximately 2.25 miles.

3.0 METHODS

Available published and unpublished literature on the effects of recreational mining, primarily with small (i.e., ≤ 4 -in diameter) suction dredges (Figure 2), in streams was collected from various sources. Articles that assessed effects of mining with 4-in and larger suction dredges and large or heavy dredge-mining (e.g., Casey and Webb 1960; Morrow 1971; Throop and Smith 1986) were reviewed but not included in the analysis although some investigators reported no adverse effects from some commercial operations. Additional information (e.g., U.S. Army Corps of Engineers Permit) was also collected and reviewed given that such permits would be required from a federal agency for proposed in-stream activities in navigable streams. All reviewed articles primarily dealt with interactions between recreational mining and components of salmonid streams although some publications differentiated between responses by salmonids and other non-game fish species. Gathered information was divided into the following potentially affected components in a stream system: fish (i.e., eggs/embryos, fry/juveniles, adult fish), habitat, and aquatic macroinvertebrates. Comments by fish management agencies, states, and the federal government on aspects of recreational suction-dredging were also included in this report although no effort was made to list the regulations that pertained to recreational mining per state; such listings are found in North (1993) and Harvey et al. (1995). Other sources of fish mortality were addressed in the discussion section.

4.0 RESULTS

4.1 EFFECTS OF RECREATIONAL SUCTION-DREDGE MINING ON FISH

4.1.1 Mortality of Salmonid Eggs and Deposited Embryos

Four investigators reported the operation of small recreational-type suction dredges had negative effects on eggs and deposited embryos. In an Idaho Fish and Game-funded study, Griffith and Andrews (1981) reported that 100 percent of un-eyed cutthroat trout *Oncorhynchus clarki* eggs died within 1 hr of entrainment in a 3-in diameter suction dredge. In the same study, eyed cutthroat trout eggs had mean mortality rates of 29 percent and 35 percent at the end of 1-hr and 36-hr periods, respectively. Eyed eggs of hatchery rainbow trout *O. mykiss* experienced a 19 percent mortality rate after entrainment and at the end of a 10-day period; control eggs experienced an 18 percent mortality rate over the same time period.

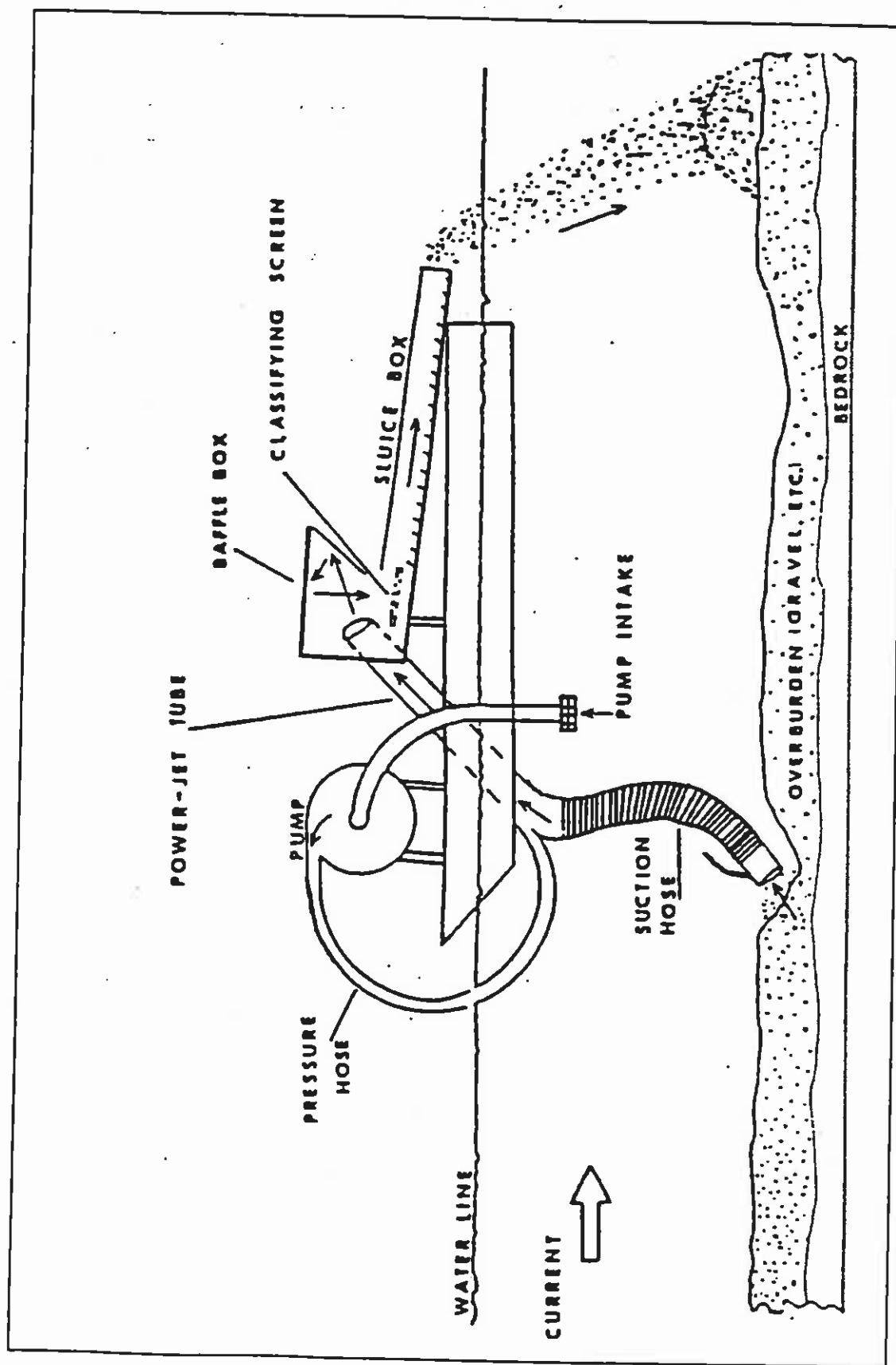


Figure 2. Cross-sectional view of a typical power-jet suction dredge used in recreational mining for gold. As proposed by the IGPA petition, the suction dredge intake nozzle (i.e., arrow from overburden into suction hose) would be ≤ 3 inches in diameter.

4.1.2 Mortality of Salmonid Sac-Fry

In an Idaho Fish and Game-funded study, Griffith and Andrews (1981) reported hatchery rainbow sac-fry experienced an 83 percent mortality rate after entrainment and a 20-day monitoring period; control fish experienced a 9 percent mortality rate over the same period. Yolk sacs were detached from approximately 40 percent of the fry during entrainment.

4.1.3 Behavior of Salmonid Adults

Operation of small suction dredges did not affect the density or movement of adult rainbow trout in the North Fork of the American River, California. Harvey (1986) reported the density of trout in downstream dredged pool-riffle sequence averaged 22.9 fish while the upstream control sequences contained 25.5 fish. In the same study, tagged rainbow trout moved very little in the control or dredged area. No tagged fish moved farther than from a pool to one of the adjacent riffles or vice versa over the two-week test period. Harvey (1986) also reported that, during low flows in late summer, eight rainbow trout moved from a nearby riffle to occupy a dredge-created pool in a stream and that dredge operation in pools did not displace trout in the same pools. Stern (1988) reported that holding locations of adult spring-run chinook salmon and adult summer-run steelhead were not affected by dredge-mining operations (i.e., 2,211 m² of stream bed) in Canyon Creek, a California stream, from the previous two years. North (1993) reviewed four published articles and four unpublished articles on suction dredge mining and concluded that dredging did not directly affect free-swimming fish. Harvey et al. (1995) reported the use of suction dredge tailings for spawning purposes by chinook and coho salmon.

4.1.4 Behavior of Non-Salmonids

Operation of small suction dredges altered the abundance of riffle sculpins *Cottus gulosus* in the North Fork of the American River, California. Harvey (1986) reported that significantly (i.e., $P \leq 0.05$) fewer sculpins were found under test rocks that offered no cover or some cover one month after dredging operations in the stream.

4.2 EFFECTS OF RECREATIONAL SUCTION-DREDGE MINING ON FISH HABITAT

4.2.1 Turbidity or Suspended Sediment in Water Column

Four studies quantified the local effects on water turbidity that resulted from the operation of recreation gold dredges in salmonid streams. Harvey (1986) reported an increase from 4-5

nephelometric turbidity units (NTUs) to 25-30 NTUs during and after dredging in the localized plume area downstream of the activity. He also reported active feeding by rainbow trout in the stream at the 25-30 NTU level. Thomas (1985) used a 2.5-in diameter suction dredge to disturb, from bank to bank, a 10-m (i.e., 33 ft) long reach of a Montana stream. She established an upstream 10-m long control reach and three 10-m long downstream response reaches. She reported that suspended sediment levels returned to ambient levels 30.5 m (i.e., 100 ft) downstream of the dredged reach. She also estimated that the bulk of the sediments, put into suspension by the dredge, was re-deposited within 6 to 11 m (i.e., 20 to 36 ft) downstream of the dredge. In comparisons with control sites, Stern (1988) reported very minor increases in turbidity (i.e., 1.58 to 1.98 NTUs) at sites 10 m downstream of dredges in Canyon Creek, California; increases declined further (i.e., 0.04 to 0.20 NTU) at sites 100 m downstream of dredges. Somer and Hassler (1992) reported very little variation in water turbidity upstream and downstream of reaches dredged by professional miners in two California streams. They reported turbidity levels exceeded 15 NTUs only near the dredge outfall. North (1993) reviewed four published articles and four unpublished articles on suction dredge mining and concluded that dredging affected turbidity temporarily but only in the immediate vicinity of the dredge.

4.2.2 Deposited Sediment on Stream Bottom

Two studies quantified the change in deposited sediments, downstream of a small dredge operation in a salmonid stream. Thomas (1985) reported that ambient sediment deposition levels (i.e., 86 g/m²/day) increased 10 to 20 times over background levels immediately downstream of a 10-m long stream reach that was dredged from bank to bank. Deposited sediment decreased exponentially with distance downstream of the dredged reach. Somer and Hassler (1992) reported that fine sediment or organic matter weights did not differ significantly (i.e., $P > 0.05$) in artificial substrate samplers retrieved, after 2, 4, and 6 weeks, in reaches, from reaches upstream and downstream of reaches dredged by professional miners in two California streams. The samplers were placed into the streams on August 31-September 1 or near the midpoint of a August 3 through October 4 dredging effort. Somer and Hassler (1992) reported different daily sedimentation rates from reaches upstream and downstream of reaches dredged by professional miners in two California streams. They reported lower sedimentation rates in a reach downstream (i.e., 12 g/m²/day) versus upstream (i.e., 13 g/m²/day) of dredging in Canyon Creek. In contrast, they reported higher sedimentation rates in a reaches downstream (i.e., 1,711 g/m²/day at 40 m and 698 g/m²/day at 113 m) versus upstream (i.e., 29 g/m²/day at 100 m and 23 g/m²/day at 50 m) of dredging in the Big East Fork Creek. Dredge operations excavated below the gravel armor level and into a fine sand and silt layer that comprised most of the transported sediments.

4.2.3 Changes in Gravel Permeability

One reviewed study reported on the change in gravel permeability after dredging in a salmonid stream. Thomas (1985) reported that gravel permeability (i.e., volume of moving water through an orifice) increased in the dredged area of a Montana stream while no changes were detected upstream or downstream of the dredged section. She concluded that silt deposition from suction dredging should not be detrimental to the development of salmonid eggs.

4.2.4 Physical Changes in Habitat

Harvey (1986) reported the basic pattern of physical change caused by small dredge operations was the formation of a hole in the stream bottom where dredging had occurred and the build-up of shallow sand-gravel areas downstream. Piles of large cobbles and boulders, too large to fit through the dredge, were also created by the dredge operator. Thomas (1985) stated that "pocket and pile" dredging techniques had a greater impact on stream channel morphology than dredging to a uniform shallow depth. She returned to two dredged sites after one year and could not determine where dredging had occurred in one site but could still detect the cobble-boulder pile at the second site. She concluded that a suction dredge could make "highly localized" changes in channel morphology. Similarly, Stern (1988) reported that flows in Canyon Creek, an anadromous fish stream in California, effectively obliterated instream mining disturbances from the previous season (i.e., 1,136 m³ or 12,229 ft³ of stream-bed). McCleneghan and Johnson (1983) investigated 235 dredge mine operations in California and reported that: 1) 176 operations met all regulations; 2) 14 operations were undercutting banks; 3) 1 operation was sluicing the bank; 4) 12 operations were channelizing the stream; 5) 7 operations were causing riparian damage; and 6) 25 operators were camping in the riparian zone. More important to the interpretation of their finding, they noted that: 1) some operators were in violation of more than one regulation; 2) their observations included some commercial placer-dredge operations; 3) 67 percent of the suction dredge operations used dredges with intakes of 4 to 10-in diameters; and 5) 53 percent of the miners were classified as professional versus recreational. Across all miners and operations, they reported that all state regulations were followed 88 percent of the time. North (1993) reviewed four published articles and four unpublished articles on suction dredge mining and concluded that dredging changed stream morphometry for a short period that lasted until the next high flow.

4.3 EFFECTS OF RECREATIONAL SUCTION-DREDGE MINING ON AQUATIC MACROINVERTEBRATES

4.3.1 Death, Injury, or Displacement of Invertebrates

Three investigators reported almost negligible negative effects to aquatic macroinvertebrates from entrainment on and passage through a recreational-type suction dredge. In an Idaho Fish and Game-funded study, Griffith and Andrews (1981) reported that less than 1 percent (i.e., 26) of the 3,623 invertebrates, entrained in a 3-in diameter suction dredge, showed injury or died within 24-hrs. Thomas (1985) reported significantly ($P < 0.05$) fewer aquatic insects in a 10-m long reach of stream that is dredged from bank to bank than in 10-m long reaches just upstream and just downstream of the dredged reach. Somer and Hassler (1992) reported that aquatic invertebrate numbers did not differ significantly (i.e., $P > 0.05$) in artificial substrate samplers retrieved, after 2, 4, and 6 weeks, in reaches, from reaches upstream and downstream of reaches dredged by professional miners in two California streams. The samplers were placed into the streams on August 31-September 1 or near the midpoint of a August 3 through October 4 dredging effort.

4.3.2 Invertebrate Diversity and Equitability

One study reported on the changes in diversity (i.e., number but not kind of species present in a sample) and equitability (i.e., evenness of the allotment of individuals among the taxa present) within invertebrate communities upstream and downstream of dredged sections of two streams in California. Somer and Hassler (1992) reported that aquatic invertebrate diversity and equitability did not differ significantly in artificial substrate samplers retrieved from stream sections upstream and downstream of a dredged sections.

4.3.3 Recolonization of Invertebrates

Three investigators reported a relatively fast recolonization rate of invertebrates following the use of a suction dredge in stream substrate. In an Idaho Fish and Game-funded study, Griffith and Andrews (1981) reported that most of the plots dredged in Summit Creek, a salmonid stream in Idaho, were completely recolonized 38 days after the dredge activity. Forty-five days after dredging with a 6-in diameter suction dredge, Harvey (1986) reported that the mean number of aquatic insects per sample in a recolonized area of Butte Creek, California did not differ significantly ($P > 0.05$) from control stations. Thomas (1985) also reported that recolonization in a 10-m long stream reach, dredged from bank to bank, was essentially complete one month after dredging. She also reported that the number of insects in the dredged reach

increased one month after dredging even when insect numbers in the upstream control and downstream impact reached had decreased; she concluded that most aquatic insects found the dredged areas were suitable habitat.

4.4 RESOURCE AGENCY COMMENTS/REGULATIONS ON THE OPERATION OF RECREATIONAL SUCTION DREDGES IN STREAMS

4.4.1 U.S. Army Corps of Engineers

Under Section 404 of the federal Clean Water Act, the U.S. Army Corps of Engineers regulates, via a permit process, the discharge of dredged or fill material into waters of the United States. The Corps (1996) recently clarified its position on the Excavation Rule as it related, in particular, to recreational dredging for gold in waters of the United States. In the special notice, the Corps defined those activities that they "determined to have *de minimis* impacts", "obvious low levels of impacts", and "inconsequential effects on aquatic resources." Within the clarification notice, the Corps defined "very small operations" as having "suction hoses ≤ 3 inches in diameter by which very small amounts of material can be moved, clearly *de minimis*. Such equipment is used where overburden is shallow and access to cracks and crevices in bedrock is easy. About ten percent of the operators (i.e., recreational) use this kind of equipment exclusively and we currently consider them to be excepted from permit requirements." The Corps then listed conditions under which excepted gold dredging activities are subject to suspension (e.g., work is conducted in a wetland).

In a related action, the Corps (Pers. comm., August 4, 1995) reviewed an application of a recreational gold miner from Oregon who proposed to use a suction dredge with a 4-in or less intake line and an engine of 10 horsepower or less on an occasional, weekend, or vacation basis. The Corps concluded that the proposed activity fell within the "intended definition of *de minimus* and that the proposed activity did not require a permit as long as the proposed activity was conducted within the exemption guidelines.

4.4.2 U.S. Forest Service

The authority for exploration, development, and removal of gold on public lands, whether by suction dredging or other methods, is the General Mining Law of 1872. Most National Forest land in the western United States are open to 1872 Mining Law activities although some local areas are withdrawn for specific reasons (e.g., wilderness areas). In a notice to U.S. Forest Service (USFS) Supervisors, Regional Foresters (Pers. comm., February 5, 1995) from USFS Regions 5 and 6 stated that the majority of the "small placer operations using suction dredges and

similar equipment in Riparian Reserves and Late Successional Reserves throughout (USFS) Regions 5 and 6...are carried out under a Notice of Intention to Operate (NOI) because of the insignificant nature of their operation." The notice differentiated between recreational suction dredge mining and larger operations that involved the "cutting of trees or the use of mechanized earth moving equipment such as bulldozers or backhoes". Such larger operations would require the submission of a proposed plan of operations because of the pre-determined likelihood of a significant disturbance to surface resources.

Harvey et al. (1995) reiterated the above comments and added that a suction-dredge proponent would also be required to submit a Plan of Operations if the Forest Service determined the proposed disturbance was significant. All operations are to minimize adverse environmental impacts and the Forest Service can require mitigation measures, bonding, and reclamation when they determine that a Plan of Operations is required for a proposed suction dredge project.

In a letter to the Idaho Gold Prospectors Club, the U.S. Forest Service-Boise national Forest (Pers. comm., February 17, 1993; Appendix A) stated that the Boise National Forest had "a very good working relationship with you (i.e., Ron Mackelprang, President IGPA) and the Idaho Gold Prospectors Club. In fact, we have documented no cases of environmental damage due to recreational mining in or near the Middle Fork Boise River. Your group has worked hard to pick up litter and (develop) other partnership efforts with the Forest." The U.S. Forest Service concluded the letter by stating that "(w)e look forward to working with you this summer on several mutual projects."

4.4.3 Idaho Department of Fish and Game

In a letter to the Idaho Gold Prospectors Club, the Idaho Department of Fish and Game (Pers. comm., July 31, 1992; Appendix A) stated that "with regards to the Middle Fork of the Boise (River), recreation type dredging could take place during July and August without seriously impacting fish production. However, the State Land Board has removed the bed of the Middle Fork of the Boise River from mineral entry. The Board did not make that decision on biological information provided by the Idaho Department of Fish and Game" (emphasis added).

4.4.3 Idaho Department of Water Resources

All recreational and commercial dredge mining is presently regulated by the Idaho Department of Water Resources within one of two formats. Some recreational mining is permitted under a "one-stop" recreational permit which includes a list of state-federal agency pre-approved streams together with appropriate seasons and rules for dredge-miners that operate for

45 days or less per year with recreational equipment (Appendix B). All recreational and commercial dredge mining, that cannot meet the conditions of the "one-stop" recreational permit, must submit a more detailed "long-form" permit which contains more rules and detailed reviews by all involved state and federal agencies (Appendix B). Additional U.S. Forest Service permits (i.e., notice-of-intent, plan of operation) are also required, in all cases on national forest land, regardless of the Idaho Department of Water Resources permit.

4.4.5 California Department of Fish and Game

The California Department of Fish and Game (1994) completed an Environmental Impact Report that examined the effects of unregulated suction dredging on all aspects of the aquatic environment which included stream beds and banks as well as riparian areas. All negative effects noted in this report above were also noted in the California report. As trustee for the fish and wildlife resources in the state of California, the Department concluded that "suction dredge mining can potentially result in the loss of this production, temporary loss of benthic/invertebrate communities, localized disturbance to stream beds, increased turbidity of water in streams and rivers, and mortality to aquatic plant and animal communities. However, based on the best available data (i.e., same data base as this report through April 1994), it is anticipated the project to adopt regulations for suction dredging as proposed, will reduce these effects to the environment to less than significant levels and no deleterious effects to fish." Proposed regulations (Appendix B) were intended to result in the maintenance of healthy lake, stream, and river systems while allowing for suction dredge mining in the state. Proposed regulations were consistent with state wildlife conservation and aquatic resource policies. To further ensure the maintenance of health in the aquatic systems in the state, the California Fish and Game Department would periodically review and amend regulations based on additional evidence and data. Lastly, the Department noted that "suction dredging is considered a legitimate activity on California's rivers and suction dredge operators have as much right as any other river user to enjoy and utilize rivers as long as their activities are within the laws and regulations of the State of California."

5.0 DISCUSSION

5.1 IMPACTS OF UNREGULATED RECREATIONAL SUCTION DREDGE-MINING ON FISH, HABITAT, AND AQUATIC MACROINVERTEBRATES

In general, almost all published and unpublished studies of unregulated suction dredge mining for gold in streams that were reviewed for this report identified some effect on fish,

habitat, and/or macroinvertebrates (i.e., fish food) in the study streams. Magnitude of impact ranged from non-detectable or even possibly positive (i.e., use of created pools for cover and cleaned tailings for spawning) to extremely negative (i.e., 100 percent mortality of uneyed cutthroat trout eggs). Across all types of impacts and excluding positive impacts and those impacts which would not occur under the present IGPA (1996) petition (i.e., no mining during incubation periods of resident or anadromous salmonids), most negative impacts were non-detectable to intermediate in size. Most of the larger negative impacts reviewed in this study were the result of violations of existing regulations that controlled the activity in a California study (McCleneghan and Johnson 1983) or were intentional at the laboratory level of study (Griffith and Andrews 1981). Relative to the California study, McCleneghan and Johnson (1983) found that most (i.e., 88 percent) of the observed recreational and professional suction dredge operators (i.e., 1-in to 10-in diameter) were mining within state regulations and that only a few operators were causing adverse impacts. Such impacts possibly to probably also occur in other states within which no regulations are in place for the activity. Most physical impacts (i.e., turbidity changes, reconfiguration of stream bottom) also occurred naturally (i.e., short to long-term storm events) and/or on a recurring basis but especially during annual spring run-off season. Regardless of the minimal nature of most impacts, however, the additional use of the stream resource by a suction dredge operator will produce some level of real or perceived change or impact as a result of the use of the stream for the activity. Some changes may not have a negative or deleterious effect on fish or fish habitat that is detectable other than at a human perception or visual level (e.g., turbidity, engine noise).

5.2 IMPACTS OF OTHER USER-GROUPS ON FISH, HABITAT, AND AQUATIC MACROINVERTEBRATES

5.2.1 Legal Fishing

The level of documented and undocumented negative effects on fish and fish habitat from other legal and regulated uses in the section of the Boise River petitioned for use by the IGPA (1996) is larger to much larger than the potential effect associated with their proposed activity. The Boise River is open to fishing by the general public throughout the petitioned 27.7-mile long reach of the Boise River and the Middle Fork of the Boise River during a majority of the year. By definition and allowed by State of Idaho regulations (Idaho Department of Fish and Game 1996), a single licensed fishermen in the reach can legally kill up to 16 trout per day (e.g., six rainbow trout and ten brook trout) over a 190 day season per year and 50 whitefish per day over a 312-day season (i.e., a single dedicated fisherman could legally kill up to 3,040 trout and 15,600 whitefish per year). If one assumed that one-half of the killed trout, in the above example, are female, that each female has 300 eggs, and that 5 percent of the eggs mature to at

least a catchable size (i.e., 6 inches), then one licensed fisherman could possibly account for the demise of additional 22,800 potential trout in one year. Similarly, the same fisherman could possibly account for the demise of additional 1,170,000 potential whitefish in the same year (i.e., same parameters as for trout except for 3,000 eggs per female). Konopacky Environmental could not find any documented case of a suction dredge killing an adult trout in any reviewed study or the unpublished literature.

In addition to actual killing of fish through harvest, another portion of the trout population in a stream can be unintentionally killed by fishermen. Even though a percentage of fish that are caught by fishermen are eventually released or escape during the time after initial hooking, a real mortality (i.e., range of 3 to 87 percent) is associated with catch-and-release fishing (Bouck and Ball 1966; Schill and Griffith 1986) that also exceeds any documented level of any mortality associated with suction dredge operation. Because there is no daily bag limit for the number of fish that can be caught and released in a stream reach, the potential mortality caused by one fisherman could be high and in addition to the mortality associated with the legal bag limit.

The IGPA-petitioned reach in the Boise River and Middle Fork of the Boise River is open to some form of fishing from January 1 through March 31 and from May 25 through December 31 during 1996 (Idaho Department of Fish and Game 1996). Various other non-commercial water-dependent activities, such as boating, kayaking, rafting, canoeing, and swimming are unrestricted and unregulated the entire year (USFS, pers. comm., July 9, 1996). As a result, fishermen and other periodic users/waders can potentially kill incubating embryos of all or some of the trout species present in the reach. Given that bull trout and brook trout are fall spawners and rainbow-redband trout and cutthroat trout are spring spawners, the simple act of walking/wading in the river can exert very large mortalities on incubating embryos over the entire IGPA-petitioned reach of the Boise River and the Middle Fork of the Boise River. Roberts and White (1992) reported that twice-daily wading on trout embryos and pre-emergent fry in redds killed up to 96 percent of the embryos and fry. A single wading killed up to 43 percent of the fish. With the exception of the intentional experiment of Griffith and Andrews (1981), Konopacky Environmental could find no published or unpublished documentation of any mortality of trout embryos or pre-emergent fry in natural stream systems from the regulated use of a suction dredge. The total combined impact of legal fish harvest, legal catch-and-release fishing, and legal wading use in a stream or river systems can potentially cause a substantial amount of mortality in trout populations in the systems.

5.2.2 Fish Management Activities

The Idaho Department of Fish and Game, in the past, has used electrofishing methods in the past to conduct inventories of fish populations within the IGPA-petitioned reach of the Boise River (Idaho Department of Fish and Game, pers. comm., June 20, 1996). Such activities, although legal and not completely necessary (i.e., other less intrusive methods such as diver-observation are available), were used by the agency to obtain data and information on the fish populations in the reach. Electrofishing does cause stress in fish through the electric shock and subsequent handling of the fish. Electrofishing can injure and kill trout embryos (Dwyer and Erdahl 1995) as well as juvenile and adult fish (Schreck 1976; Sharber and Carothers 1988). Other less intrusive but legal management activities (e.g., stocking of trout) can also have negative effects on wild trout populations through competition for food and space in the stream. Konopacky Environmental could find no published or unpublished documentation of cause-effect mortality of trout, in natural stream systems, from the regulated use of a suction dredge.

5.2.3 Road Maintenance, Agriculture, and Livestock Grazing

At least three other legal and regulated activities in the IGPA-petitioned reach of the Boise River have negatively impacted fish and fish habitat, in direct and indirect manners, for years. The large number of miles of maintained and non-maintained but unpaved roads contribute many tons of fine sediments to the stream via road use, wind, and periodic maintenance (i.e., winter plowing and summer grading). Although the roads are necessary for various uses, including fishing and hunting in the area, sediment contributions to the system can adversely affect fish embryos in redds (Tappel and Bjornn 1983), macroinvertebrate communities (McClelland 1972), and fish habitat (Bjornn et al. 1977). Although the action of a suction dredge may redistribute the fine sediments within the substrate of a stream system, a suction dredge or the operation of a suction dredge does not produce sediment or contribute sediment to a stream channel.

In addition to unpaved roads, regulated irrigation withdrawals and return flows as well as regulated agricultural and livestock uses in the IGPA-petitioned reach of the Boise River can have negative impacts on fish and fish habitat. Irrigation diversions in the IGPA-petitioned reach of the Boise River reduce the amount of water available for trout especially during the low-flow late-summer periods. Depending on the data base used, a total of 60 to 80 water rights or diversions of between 0.04 and 19.0 ft³/sec exist in the 30 miles of river upstream of Arrowrock reservoir (Idaho Department of Water Resources, pers. comm., June 20, 1996). Return of used irrigation water unnaturally warms the water and adds sediment and possibly nutrients (e.g., fertilizer) to the water. Livestock grazing occurs on Boise National Forest lands adjacent to the IGPA-petitioned reach of the Boise River (Boise National Forest, pers. comm., June 20, 1996).

Cattle trailing and cattle/sheep in grazing allotments can negatively affect fish and fish habitat through trampling of fish embryos in redds in riffle crossing areas and the destruction of riparian vegetation through trailing and dispersed grazing. Although unregulated or illegal suction dredge use could add sediment to streams (e.g., mining of banks) and also impact embryos in redds, Konopacky Environmental could not find no published or unpublished account of the use of a suction dredge that heated stream water, added nutrients to stream water, added sediment to stream water, or destroyed riparian vegetation.

At least one state and one federal resource agency have stated that other regulated and legal uses in a stream drainage have a greater negative impact on fish and fish habitat than the operation of suction dredges by recreational miners. The California Department of Fish and Game (1994), after recognition of the long history of impacts to California rivers and streams associated with other recreational and commercial activities, concluded that the "cumulative detrimental effects of these activities are more significant to the overall health of fish and fish habitat than the impacts caused by suction dredging." Similarly, Harvey et al. (1995), in the development of a review and management strategy for suction dredging on U.S. Forest Service lands, conclude that "the scale of effects of individual dredges appears small, in contrast to other impacts affecting stream biota such as fishing, water diversions, road construction, and logging." Konopacky Environmental agrees with the two above agencies and suggests that regulated suction dredging can occur in a river system, such as the Boise River, with less impact on fish and fish habitat than other ongoing regulated and unregulated activities.

5.3 POTENTIAL IMPACTS OF REGULATED RECREATIONAL SUCTION DREDGE-MINING ON FISH, HABITAT, AND AQUATIC MACROINVERTEBRATES

The IGPA (1996) petition to use suction dredges to remove gold from a 27.7-mile reach of the Boise River system will have non-detectable to very minimal negative effects on fish and fish habitat in the Boise River system. The IGPA petition differs from most reviewed studies and would have such minimal effects because: 1) the petition already has "built-in" regulations (e.g., dredge season relative to incubation of fish embryos, ≤ 3 -inch intakes); 2) the IGPA has informed the Board that the groups wishes to operate within a regulated format; 3) the IGPA has a documented history of self-imposed positive rules and aspects (e.g., litter patrols); and 4) the IGPA has good rapport with land management agencies (e.g., U.S. Forest Service). Such a limited effort in a limited reach of a river system can only have limited effects. Some of the limited effects probably occur naturally or are much smaller in magnitude than similar effects presently incurred by the fish and fish habitat by other legal and state-regulated activities within the Boise River system. In contrast, the California Fish and Game (1994) Environmental Impact Report stated that some positive effects of recreational gold mining with dredges included the

removal of lead, mercury, and other heavy metals with a concomitant increase in dissolved oxygen through the mechanical action of the dredge in the stream.

5.4 CONCLUSIONS

After our review of the published and unpublished literature on the effects of recreational suction dredge use on fish and fish habitat in the western United States, Konopacky Environmental makes the following conclusions: 1) impacts to fish and fish habitat from the regulated use of recreational suction dredges, in the IGPA-petitioned reach of Boise River upstream of Arrowrock Reservoir, will be non-detectable to minimal; 2) a non-detectable to large range of impacts to fish and fish habitat can occur with the unregulated use of recreational suction dredge in streams like the Boise River; and 3) other ongoing, legal, regulated and unregulated activities in the Boise River, in the reach upstream of Arrowrock Reservoir, will have larger detrimental or negative impacts to fish and fish habitat than the recreational use of suction dredges.

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APPENDIX A



IDAHO FISH & GAME

600 South Walnut
P.O. Box 25
Boise, ID 83707-0025

July 31, 1992

Mr. Ronald B. Mackelprang
Idaho Gold Prospectors Club
3522 Red Oak Drive
Boise, Idaho 83703

Dear Mr. Mackelprang:

I have received your letter of July 8, 1992 and have discussed the recreational dredging issue with Idaho Fish and Game (IDFG) Region 3 personnel and the Idaho Department of Water Resources (IDWR). As I mentioned at our meeting, recreational dredging will have an impact on eggs and juvenile fish in the substrate. We also become concerned with any activity which has the potential to cause accelerated erosion.

With regards to the Middle Fork of the Boise, recreation type dredging could take place during July and August without seriously impacting fish production. However, the State Land Board has removed the bed of the Middle Fork of the Boise River from mineral entry. The Board did not make that decision on biological information provided by the IDFG.

The IDFG initiated efforts to have the South Fork of the Salmon River and its tributaries removed from mineral entry. In areas with spawning potential, a salmonid life form is in the substrate at all times of the year. In addition, the IDFG does not believe it in the best interest of the fish to allow any type of activity which could pose a hazard to the recovery of salmon or steelhead.

If you have additional questions, please call me at 334-2598 or writing to 600 South Walnut, Boise, Idaho 83702.

Sincerely,

Will Reid
Fishery Program Coordinator

WR:kdd

cc: Director's Office
Region 3

Cecil D. Andrus / Governor
Jerry M. Conley / Director

Equal Opportunity Employer



Working for wildlife since 1935



Reply to: 2800

Date: February 17, 1993

Mr. Ron Mackelprang, President
Idaho Gold Prospectors Club
3522 Red Oak Drive
Boise, ID 83703

Dear Mr. Mackelprang:

We, on the Boise National Forest, have a very good working relationship with you and the Idaho Gold Prospectors Club. In fact, we have documented no cases of environmental damage due to recreational mining in or near the Middle Fork Boise River. Your group has worked hard to pick up litter and other partnership efforts with the forest.

The vast majority of toxic sediment in the Middle Fork Boise River bed remains behind the newly reconstructed Kirby Dam. Some sediment that did wash down river during the collapse is spread out on the bottom of the river between the dam site and the Weatherby Mill site. Mercury and arsenic attached to the sediment particles is not soluble in river water. The river water would have to be around pH 3 for the mercury and arsenic to go into solution. The river water is pH 6.5. This means the safety hazard to recreational miners is minimal.

If you have any questions, feel free to contact me at 364-4149 or Jim Curtis at 364-4136. We are looking forward to working with you this summer on several mutual projects.

Sincerely,

W. WAYNE PATTON

cc
W. Patton



SUCTION DREDGE FACTS

- 1a. Fish survival especially in times of drought is greatly enhanced by the presence of artificially created holes. (N. Am. J. Fish. Mgmt 14:37, 1994)
- 1b. Abandoned dredge holes provide holding and resting areas for fish. (M. S. Thesis, Humbolt St. U. 1988 by Stern)
2. Trout production was significantly increased by physically sculpting and altering the stream habitat. (Trans. Am. Fish Soc. 91:185)
3. Capacities of suction dredges in field conditions are only 2% of manufactures ratings. (N. Am. J. Fish. Mgmt. 1:21, 1981)
4. Capacities of suction dredges decrease by 4 times as the nozzle size decreases by 1/2. (N. Am. J. Fish. Mgmt. 1:21, 1981)
5. Suction dredges produce clean, de-silted gravels ideal for fish spawning. In addition, they break up the hardened river bottom substrate that prohibits aquatic life entry. Similiar to cultivating your garden. (Calif. Dept. F&G Memo Sept. 17, 1962, Suction Dredge Invest. by Lewis)
- 6a. Suction dredges remove heavy metals such as lead, mercury and arsenic compounds. (Final EIS, Ca. Dept. F&G, 4/94, p. 64, Adopt. Reg. for Suc. Dredges)
- 6b. Lead and mercury level in fish have been linked to lower reproduction rates. (Bull. Enviro. Contam. & Tox. Vols. 41, 43 pgs. 329, 852.)
7. Disturbed gravels are re-colonized by aquatic insects within 40 days, fewer than 1% showed injury or died after passing through the suction dredge. (N. Am. J. Fish. Mgmt. 1:21, 1981)
8. Dredges are being used by the Forest Service to remove silts from Idaho rivers. (Video Outdoor Idaho October 1992)
9. Dredges aerated the water and result in increased oxygen content down stream which oxidizes nutrients and increases water quality. (Beneficial effect never measured by researchers)
10. The effects of regulated suction dredge mining are insignificant:
(Final EIS, Ca. Dept. F&G, Apr. 1994, pg. 64, Adopt. of Reg. for Suction Dredges)
(B.C. Harvey, N. Am. J. Fish. Mgmt. 6:409, 1986)
(V. G. Thomas, N. Am. J. Fish. Mgmt. 5:488, 1985)
11. Science favorable to suction dredge mining does exist (see above). However, ALL the available science on the effects of suction dredge operation are based upon unregulated operations involving the impact of large scale operation and/or ignoring all established rules and best management practices. In addition, it is not comprehensive in that it does not take into account the concurrent impacts of such things as fishing, droughts and natural diasters / disturbances. On the other hand, science on the effects of regulated fishing is 100% consistant that the impact are significant!
12. Impacts of all users: prospectors, fishermen, rafters etc. need to be inventoried, compared and rated. Then restrictions administered accordingly.

The Effects of Extreme Floods and Placer Mining on the Basic Productivity of Sub Arctic Streams

Alaska Univ., College. Inst. of Water Resources.

Completion rept.

AUTHOR: ECKROW, James E.

A2712F3 FID: 8H, 6F, 64H, 68D, 57H USGFCF7118

1971 12F

FEPT NO: IWR-14

PROJECT: CWERB-A-027-ALAS

ENITCE: CWERB-A-027-ALAS(1)

ABSTRACT: The primary purpose was to establish whether or not mining activity or flooding would affect levels of vegetation and animal life in a sub-arctic stream. The majority of samples taken were in riffle areas, not throughout the whole stream system. Small mining operations do not appear to adversely affect the fauna. Additionally, extreme flooding (Fairbanks, Alaska - August 1967) does not seem to have destroyed bottom dwelling organisms, as the levels in 1968 indicated complete recovery. However, there is every indication that parameters such as pH, EC, temperature, and basic productivity as it relates to these, would be definitely changed when exposed to a large scale operation or high organic overburden. (WRSIC Abstract)

DESCRIPTORS: (*Streams, Industrial wastes), (*Water quality, *Alaska), Mining, Floods, Vegetation, Dissolved gases, Animals, Plants(Botany), Primary biological productivity, Water pollution, Arctic regions

FE-201 654 NTIS Prices: PC\$3.00 MF\$0.95

FINAL ENVIRONMENTAL
IMPACT REPORT

ADOPTION OF REGULATIONS
FOR
SUCTION DREDGE MINING

APRIL 1994

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME

L SUMMARY

SUMMARY OF PROPOSED ACTIONS

The proposed project is the adoption of regulations by the Department of Fish and Game (Department) which would provide for the issuance of annual permits allowing individuals to suction dredge mine in specific streams, rivers and lakes during specified time periods. The regulations would specify terms and conditions for suction dredge operations and would designate which waters of the State would be opened to suction dredge mining. In adopting regulations for suction dredge mining, the Department would be acting in accordance with and pursuant to sections 5653 through 5653.9 of the Fish and Game Code which provide the authority for the regulation of suction dredge mining (Appendix A). The proposed project is specific to suction dredge mining of minerals and does not apply to dredging associated with maintaining navigable waters or sand and gravel mining.

The proposed project would be consistent with the wildlife conservation policy adopted by the Legislature and described in Section 1801 of the Fish and Game Code (Appendix A). The State's wildlife conservation policy includes the objectives of maintaining sufficient populations of all species of wildlife necessary to provide for the beneficial use and enjoyment of all species of wildlife by all citizens of the State and perpetuating all species of wildlife for their intrinsic and ecological values, as well as for their direct benefits to people.

The proposed project would also be consistent with the State's aquatic resources policy as set forth in Section 1700 of the Fish and Game Code which encourages, among other things, the maintenance of sufficient populations of all species of aquatic organisms to ensure their continued existence (Appendix A).

Protection and management of fishery resources (fish are defined in Section 45 of the Fish and Game Code as fish, mollusks, or crustaceans, invertebrates, or amphibians, including any part, spawn, or ova thereof), protection and management of aquatic and riparian communities which support fish habitat, and protection of threatened or endangered plant and animal species, and species of special concern would be the basis for the Department's recommendations regarding the regulation of suction dredge mining.

The proposed project would minimize the impacts to fish and other resources from suction dredge mining. Its objective would be to maintain fish populations and other resources dependent upon the aquatic environment while providing public suction dredge mining opportunities in the State of California. Absent regulations, the impacts of suction dredging to the environment would be significant and deleterious.

V. ENVIRONMENTAL EFFECTS OF THE PROPOSED PROJECT

The proposed regulations would permit regulated suction dredging in California's waters. Unregulated suction dredging can potentially result in deleterious and sometimes significant adverse environmental effects to: (a) benthic (bottom dwelling) and/or invertebrate communities, (b) fish and fish eggs and fry, (c) other aquatic or riparian dependent plant and animal species, (d) channel morphology which includes the bed, bank, channel and flow of streams and rivers, (e) water quality and quantity, and (f) riparian habitat adjacent to streams and rivers (North, 1993, Badali, 1988, Griffith and Andrews, 1981, Harvey, 1986, Harvey and McCleneghan, 1982, Hassler and Somer, 1982, Hassler, Somer and Stern, 1986, Lewis, 1962, McCleneghan and Johnson, 1983, Thomas, 1985).

But based on the best available data specific safeguards included in the proposed project would assure that the impacts to these resources would not be deleterious to fish and would be minimized to less than significant. The safeguards to protect the affected resources include; 1) the designation of waters or areas of the State closed to suction dredging; 2) seasons of operation where suction dredges may be used; and 3) a variety of conditions and restrictions on methods of operation described in Chapter I and III of this document, and in Appendix G, Proposed Regulations.

The proposed regulations take into consideration the degrading condition of the State's rivers and riparian areas and declining status of species including threatened and endangered species as documented in many current documents including California's Rivers, A Public Trust Report, State Lands Commission, 1993, Upper Sacramento River Fisheries and Riparian Habitat Management Plan, 1989, Sliding Toward Extinction: The State of California's Natural Heritage, 1987, Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants, 1991, Fish Species of Special Concern of California, Department, 1989, Draft Central Valley Anadromous Fisheries and Riparian Wetlands Habitat Protection and Restoration Action, Department, 1993, The Central Valley Fish and Wildlife Management Study, BOR, 1986, and Biodiversity Loss in the Temperate Zone: Decline of Native Fish Fauna in California, Moyle and Williams, 1989. Given the depressed state of river resources in California, as the trustee for fish and wildlife resources for the State of California, the Department has a duty to reduce the adverse impacts on fish and wildlife resources whenever possible. These resources include fish habitat and riparian resources. Thus the Department must take a conservative approach to permitting activities that may adversely affect those resources.

OVERVIEW OF THE EFFECTS OF SUCTION DREDGING ON THE ENVIRONMENT

↓
Effects of unregulated suction dredging on the aquatic environment and fish are documented in scientific literature. Most of the studies have focused on cold water stream environments that support salmon, steelhead or trout.

CONCLUSION

The Department is the trustee for fish and wildlife resources of the State of California. The Department is charged with protecting and managing fish populations and other related aquatic dependent resources in a sound biological manner.

Suction dredge mining can potentially result in the loss of fish production, temporary loss of benthic/invertebrate communities, localized disturbance to streambeds, increased turbidity of water in streams and rivers, and mortality to aquatic plant and animal communities. However, based on best available data, it is anticipated the project to adopt regulations for suction dredging as proposed, will reduce these effects to the environment to less than significant levels and no deleterious effects to fish.

The proposed regulations would result in the maintenance of healthy lake, stream and river systems while allowing for suction dredge mining in California. To further ensure the maintenance of healthy lake, stream and river systems in California, the Department would periodically review and amend regulations based on additional evidence and data.

It should be noted that suction dredging is considered a legitimate activity on California's rivers and suction dredge operators have as much right as any other river user to enjoy and utilize rivers as long as their activities are within the laws and regulations of the State of California.

The Department recognizes there is a long history of other impacts to California's rivers and streams associated with other recreational and commercial activities. These activities include the construction of dams, commercial mining, rafting, fishing, road building and logging. In comparison, the cumulative detrimental effects of these activities are more significant to the overall health of fish and fish habitat than the impacts caused by suction dredging. All negative impacts to the State's rivers are of concern to the Department due to the continuing decline of fisheries and riparian habitat throughout the State. An overview of the historic and current declining condition of the State's rivers and fisheries resources is provided in the 1993 California State Lands Commission's report "California's Rivers - A Public Trust Report".

Effects of Angler Wading on Survival of Trout Eggs and Pre-emergent Fry

BRUCE C. ROBERTS¹ AND ROBERT G. WHITE

U.S. Fish and Wildlife Service, Montana Cooperative Fishery Research Unit²
Montana State University, Bozeman, Montana 59717, USA

Abstract.—The effects of angler wading on trout eggs and pre-emergent fry in artificial redds depended on wading frequency and stage of egg or fry development and was similar for brown trout *Salmo trutta*, rainbow trout *Oncorhynchus mykiss*, and cutthroat trout *O. clarki*. Twice-daily wading throughout development killed up to 96% of eggs and pre-emergent fry. A single wading just before hatching killed up to 43%. Wading killed fewest eggs between fertilization and the start of chorion softening (except for a short period during blastopore closure when mortality increased slightly). It killed the most eggs or fry from the time of chorion softening to the start of emergence from the gravel. Restriction of wading could be an effective management tool if trout spawning habitat is limiting and angler use is high during egg development.

A variety of environmental factors can limit trout populations. Spawning habitat is known to limit anadromous salmonid populations but rarely limits resident trout (McFadden 1969). As the popularity of trout fishing has increased, however, questions have arisen about the effect of angler wading on trout recruitment. This question was brought to the forefront in Montana when the State Supreme Court granted public access to all flowing waters. The 1983 ruling allows anglers to wade and fish in all streams between the "ordinary high-water marks" if access is gained legally.

In May 1985, the State Legislature directed the Montana Department of Fish, Wildlife and Parks to adopt rules for the management of recreational use of rivers and streams. A process was established by which persons may petition the Fish and Game Commission to restrict public access to streams if probable detrimental effects of recreational use can be demonstrated.

The first petition filed requested that Nelson Spring Creek be closed to recreational use without permission of the landowners because unlimited wading through important spawning areas would adversely affect recruitment to the trout fishery in both Nelson Spring Creek and the nearby Yellowstone River. We designed this study to test the effects of angler wading on the survival of trout eggs and pre-emergent fry. The null hypothesis to

be tested was that angler wading would not reduce survival in redds of brown trout *Salmo trutta*, rainbow trout *Oncorhynchus mykiss*, and cutthroat trout *O. clarki* containing eggs or pre-emergent fry.

Methods

Multiple-Wading Experiments

To evaluate the effects of wading on the survival of eggs and pre-emergent fry of brown trout, rainbow trout, and cutthroat trout, we conducted three laboratory experiments at the U.S. Fish and Wildlife Service Fish Technology Center, Bozeman, Montana. To reduce variability inherent in natural stream channels, we experimented in three constructed channels, each 1.2 m wide × 2.4 m long. Each channel was subdivided into eight chambers, 1.2 m long × 0.3 m wide × 0.33 m deep and filled with rounded stream gravel (Figure 1). Washed stream gravel from local gravel quarries was mixed in a portable cement mixer to match the mean particle-size distribution of five McNeil substrate samples (McNeil and Ahnell 1964) from known spawning areas in Nelson Spring Creek (Table 1). Water flow through each chamber was adjusted to 0.14 ± 0.005 L/s. Gradient in each chamber was near 2%. Dissolved oxygen concentrations (mg/L) in the inflow and outflow were measured periodically. A Taylor recording thermograph monitored water temperature continuously. We calculated Celsius temperature units (CTUs)—the sum of mean daily temperatures above 0°C—to monitor development rates and predict stages of development.

To prepare for planting eggs, we placed a 10-cm layer of gravel in the bottom of each chamber

¹ Present address: U.S. Forest Service, Intermountain Research Station, 316 East Myrtle Street, Boise, Idaho 83702, USA.

² Cooperators are the U.S. Fish and Wildlife Service, the Montana Department of Fish, Wildlife and Parks, and Montana State University.

Reproductive Indices as Measures of the Effects of Environmental Stressors in Fish

EDWARD M. DONALDSON

*West Vancouver Laboratory, Biological Sciences Branch
Department of Fisheries and Oceans, 4160 Marine Drive
West Vancouver, British Columbia V7V 1N6, Canada*

Abstract.—Acute reproductive failure in response to severe stress can result in the rapid elimination of fish populations, and reproductive impairment results in the gradual elimination of fish populations. Biological indicators of the impact of environmental stressors on reproduction can be categorized as short-term or long-term measures. Short-term indicators, which can be used either in the field or in the laboratory and vary in degree of sophistication, include sperm motility; alteration in percentage hatch or time of hatch; presence of atretic ova; altered androgen, estrogen, or progesterone concentrations at a single point in the reproductive cycle; failure to spermiolate or ovulate; and impairment of spawning. Long-term indicators also can be field or laboratory based; examples are measurement of hormonal changes and timing of reproductive events in a migratory species before and after an anticipated environmental impact, and implementation of partial or complete life cycle tests in a controlled laboratory environment. The use of reproductive variables as critical indicators of the presence of environmental stressors is discussed in the context of new endocrine and nonendocrine methodologies.

The potential value of reproductive variables for evaluation of the effects of stressors on fish has been recognized for several years (Billard et al. 1981; Donaldson and Scherer 1983). Birge et al. (1985) stated that "reproduction in aquatic animals usually is the most critical function affected by chronic toxicant stress." However, despite the development of improved endocrine methodologies and analytical techniques over the last two decades, few investigators have used reproductive indices to evaluate the effects of physical and chemical stressors on fish.

It is axiomatic that reproduction is essential to the continued existence of all species of living organisms. It thus follows that any stressor that interferes with the process of reproduction at the individual or population level is likely to affect the survival of that species in that habitat. Furthermore, any factor that interferes with survival to reproductive maturity, although not necessarily having a direct effect on the reproductive process, will inevitably and adversely affect reproduction. Conversely, the survival of individuals in a particular environment does not necessarily imply that they will reproduce.

Successful reproduction by teleosts requires that several environmental variables fall within critical ranges for each species at each stage of the reproductive process from spermatogenesis or oogenesis through final maturation, spermiolation or ovulation, fertilization, embryonic develop-

ment, and sex differentiation. These environmental factors include temperature, photoperiod, salinity, rainfall, turbidity, oxygen concentration, ammonia concentration, water flow, and the availability of an appropriate animate or inanimate spawning substrate.

The effects of environmental stressors on reproduction ultimately reveal themselves at the population level. A severe acute stressor can cause immediate reproductive failure and rapid elimination of fish populations. A moderate chronic stressor, on the other hand, may cause reproductive impairment, which leads to the gradual reduction or elimination of fish populations (Figure 1). For example, under conditions of moderate stress, fecundity may be reduced (Suter et al. 1987) or the proportion of individuals metabolically capable of reproduction may be reduced.

Reproductive Impairment

In the broad sense, any stressor-induced change in a biochemical, physiological, morphological, developmental, or behavioral variable that ultimately influences the ability of the fish to reproduce could be regarded as an indicator of reproductive impairment. In the narrow sense, any stressor-induced change in the reproductive process itself that influences the ability of the fish to reproduce would clearly be a candidate for

Influence of Capture Methods on Blood Characteristics and Mortality in the Rainbow Trout (*Salmo gairdneri*)¹

GERALD R. BOUCK AND ROBERT C. BALL

Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan

ABSTRACT

Blood characteristics and mortality were compared between rainbow trout which were captured by (1) angling with artificial lures, (2) electroshocking, and (3) seining. The hemoglobin concentration, erythrocyte sizes, plasma protein concentrations, and plasma protein fractions varied according to the method of capture. Mortality was negligible in the shocked and seined lots, but was above 85% in the hooked fish group. Mortality was delayed and the symptoms suggest progressive shock. Definite differences in behavior were noticed in the postcapture fish and included prolonged fasting (shocked and hooked fish), hyperexcitability (shocked fish), and lethargy (hooked fish). The authors believe that presently used methods of capturing and handling fish should be re-evaluated, particularly if the fish are to be used in toxicological or management studies.

INTRODUCTION

The meaningful measurement of sublethal levels of pollution is most difficult and perhaps offers the most challenging area of research in the field of aquatic ecology. As an approach to measuring these stress levels, which are postulated to be related to pollution in the environment, electrophoretic analyses are promising because certain changes in the composition of plasma (or serum) proteins are indicative of stressful conditions (Bier, 1959). In man, the general increase of low-mobility proteins is so common to stressful conditions that Dunn and Pearce (1961) have called this a "stress" pattern. Similar changes have been demonstrated in fish by Fujiya (1961) and we have demonstrated that this also occurs in at least three other species of fish (Bouck and Ball, 1965). To use these changes, it is vitally important to recognize normal plasma protein composition. But it is equally important to distinguish between pollution-induced changes and artifacts induced by the methods of capturing the specimens. In this report, we are presenting the results of a study on the effects of capture methods on postcapture mortality and the composition of the blood from rainbow trout (*Salmo gairdneri*).

We have used electrophoresis in studies concerning low oxygen pressures and the effects of heavy metal ions on fish, and the re-

sults indicate that it could be a valuable tool in field studies of pollution. Fujiya (1961) utilized serum from fish kept in live-boxes to detect stressful areas in a freshwater bay. However, blood from freshly collected resident fish seems more desirable for these purposes, provided that the capture process does not change the plasma protein composition.

Various methods have been used by others to capture fish intended for blood studies and these methods include gill-netting, angling, and electroshocking. While these methods are not known to cause a physiological stress reaction, we are aware of no studies which show that such is not the case. Perhaps the method of capture accounts for the high degree of variability in physiological parameters noted by other investigators (reviewed by Bouck, 1964). Therefore, the influence of capture must be recognized and quantified before attempts to relate the composition of plasma proteins from resident fish to adverse environmental conditions. Likewise, the influence of capture methods on postcapture mortality is important because it indicates the degree of stress involved.

For our work, we chose to compare the effects of capture by electroshocking and angling to capture by seining. These methods present several problems and, in particular, we were concerned with the time lapse between capture and the time when blood could be collected. In seining and shocking, one usually captures large numbers of fish which can be sampled immediately. Specimens are cap-

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tured at a slower rate by angling, however, efforts to escape the hook expected to influence the specimen. To standardize our procedures for experimental lots, we allowed 1 hour after their capture before drawing from the first specimen. Thus this does not describe the changes in blood which persist for less than 1 hour (more).

METHODS AND MATERIALS

Approximately 120 rainbow trout, obtained from the Wolf Lake Hatchery, Michigan Conservation Department, in 1962. The fish were of uniform size, a mean weight of 90 grams and a length of 20 centimeters. Specimens were assigned randomly to three sections of a concrete pond which had a surface area of 20 feet and a maximum depth of 3 feet. Tap water filled the pond and its temperature ranged from 6 to 10 C during the experiment. This water was at or near saturation for oxygen at each testing. Total dissolved solids remained near 300 ppm and the pH was very close to 8.3. Fish food pellets were fed to the fish each day.

After 6 days in the pond, specimens were collected by angling with artificial lures. Fish which exhibited bleeding were eliminated from the experiment. Each fish was "placed" in a container indicating exhaustion. The hook was removed while the specimen was out of the water. Then the fish was placed into one of the live-boxes. In sum, we attempted to capture a rainbow trout by a method which was as close as possible to the capture of a rainbow trout by a fisherman, i.e., tossing a coin, the fish in one lot were assigned to the blood study and the other two lots assigned to the mortality study. Two days later, control specimens were collected and assigned in the same manner. Two days later, specimens were collected by electroshocking with a hand-held 20-volt d-c generator with hand-held electrodes. The stunned fish were netted, if possible, removed from the field, and assigned as before.

Specimens for the mortality study were transferred to three tanks containing water of aged tap water drawn from the same source. This water was continuously aerated with compressed air. Each lot (seining,

¹ Published with the approval of the Director of the Michigan Agricultural Experiment Station as Journal Article No. 3683.

Mortality of Anadromous Coastal Cutthroat Trout Caught with Artificial Lures and Natural Bait

GILBERT B. PAULEY¹ AND G. L. THOMAS²

Washington Cooperative Fish and Wildlife Research Unit³
College of Ocean and Fishery Sciences, University of Washington
Seattle, Washington 98195, USA

Abstract.—The mortality of anadromous coastal cutthroat trout *Oncorhynchus clarki* taken by anglers with worm-baited hooks of four different sizes, spinners with single hooks, spinners with treble hooks, and spinners with treble hooks baited with worms was investigated on the Stillaguamish and Snohomish rivers in Washington. In all but two comparisons mortality of cutthroat trout was greater ($P < 0.05$) from the four sizes of worm-baited hooks (39.5–58.1%) than from the three different spinner treatments (10.5–23.8%). The probability of killing fish was greater ($P < 0.05$) when fish were hooked in either the gill (95.5%), tongue (66.7%), esophagus (65.5%), or eye (53.8%) than in other anatomical locations. A group of untagged fish that were caught on worm-baited hooks but hooked only in the jaw or mouth were used as control fish to evaluate tagging mortality. The mortality of the untagged group (7.4%) was not greater than the mortality of fish caught on all terminal gear types and hooked in the upper or lower jaw (5.8%), suggesting that mortality from tagging was not an important factor. Mortality was positively related to bleeding at the time of hooking. Hooking a fish in a critical anatomical part was the most important factor causing subsequent mortality.

Anadromous coastal cutthroat trout *Oncorhynchus clarki* are found in most maritime tributaries on the west coast of North America from Prince William Sound in south-central Alaska to Humboldt Bay in northern California (Pauley et al. 1989; Trotter 1989). Surveys of anglers conducted by the National Marine Fisheries Service in 1974 in the Puget Sound area suggested that anadromous coastal cutthroat trout were second only to salmon in popularity among saltwater anglers (Johnston and Mercer 1976). To ensure that the populations of native sea-run cutthroat trout are not overexploited, the Washington Department of Wildlife (WDW) initiated a management policy that allows all female fish to spawn at least once (Mongillo 1984). To accomplish this, WDW refined harvest regulations for anadromous cutthroat trout by location of the fishery, creel limits, and size restrictions for harvest of fish. Gear restrictions to reduce mortality of released fish also would be beneficial. The success of this type of regulation depends on identification of the factors that cause mortality of released fish.

Hooking mortality in resident cutthroat trout (Hunsaker et al. 1970; Marnell and Hunsaker 1970; Gresswell 1976; Dotson 1982; Schill and Griffith 1986; Titus and Vanicek 1988) and anadromous steelhead (anadromous rainbow trout *Oncorhynchus mykiss*) (Reingold 1975; Permit 1977) has been examined; however, this report is the first on hooking mortality in native populations of anadromous coastal cutthroat trout. The objective of the study was to estimate and evaluate the causes of hooking mortality of anadromous coastal cutthroat trout by standard angling methods with worm-baited hooks and spinning lures.

Study Area

Cutthroat trout were caught from two river systems that drain into central Puget Sound, Washington: the Snohomish River system (35 mi north of Seattle), including its two main tributaries, the Skykomish and Snoqualmie rivers, and the Stillaguamish River (55 mi north of Seattle). Most fish taken from the Snohomish River were caught in the tidal reaches of the river downstream from the town of Snohomish. However, a few fish were caught above tidal influence. All fish caught in the Skykomish and Snoqualmie rivers were above any tidal influence. All fish caught in the Stillaguamish River were taken upstream from tidal influence in a 4-mi section of the river just below the confluence of the north and south forks of the river. Both river systems have populations of anadromous

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Immunological Indicators: Effects of Environmental Stress on Immune Protection and Disease Outbreaks

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Abstract.—The immune response in fish can be compromised by environmental stressors. Researchers have shown that exposure to phenol in the water can reduce the numbers of antibody-producing cells; some drug treatments may diminish macrophage activities; and pesticide derivatives can inhibit lymphocyte proliferation. Immunological tests such as particle agglutination, fluorescent antibody techniques, and enzyme immunosorbent assays are used routinely to monitor for disease-causing agents in fish at hatcheries, farms, and aquaculture facilities and can also be used to indicate environmental stress. Fishery biologists use the information from these tests to decide whether measures should be taken to immunize fish or treat them with drugs or, if possible, to alter the environment to prevent disease outbreaks. In many cases, pathogens are already present in the environment or carried by the fish, and a compromised immune system makes the fish more susceptible to these agents. Because fish protect themselves against diseases and harmful antigens by a complex immune system similar to that of humans and other animals, the physiological pathways are known. The cellular components include macrophages for pathogen surveillance and antigen uptake, monocytes for transportation of antigens to the kidney and splenic immunopoietic sites, and multiple subpopulations of lymphocytes for target destruction and antibody production. These cells and organs are linked through biochemical signals that are susceptible to immunomodulation by well-recognized drugs and chemicals. If tests indicate that the immune system is compromised, disease outbreaks may be predicted and steps can be taken to save the fish.

Fish in all environments, including hatcheries, fish farms, aquaculture facilities, and natural waters, sometimes die because of stressful conditions. Fishery biologists have recognized that rapid temperature changes, handling, and deterioration of water quality adversely affect fish health (Wedemeyer 1970; Snieszko 1974; Zeeman and Brindley 1981; Anderson et al. 1984; Zeeman 1986). Although fish often appear to be healthy before, during, and immediately after a period of stress, a disease outbreak or chronic mortality may develop in the population later, and a specific pathogen may be isolated or implicated. Many fish are asymptomatic carriers of pathogens that under normal conditions are held in check by the immune system. When that system is impaired or depressed by stress, the disease-causing agent may multiply, gain control, and kill its host. Fish protect themselves against pathogenic microorganisms by an immune system comparable to that of humans and other vertebrates. The rapid expansion of the science of immunology has revealed the complexity of this finely tuned system, which consists of a multitude of nonspecific defense barriers and specific immune functions. The first line of nonspecific protective defenses in-

cludes physical guards and barriers such as scales and skin, the components of mucus, lysozymes and other bacteriolytic enzymes, and the viscous mucopolysaccharides that impede the movement of microorganisms. If these barriers are penetrated by a pathogen, the resulting inflammation attracts phagocytic cells, neutrophils, and other leukocytes that destroy the invader. In contrast, the specific immune response is an induced reaction to particular, individual invaders or antigens, and involves specialized factors that are produced by communication among cell receptors, signal molecules, and mediators. The first component of the specific immune response, the afferent system, receives and processes invasive materials and provides information to the second component, the efferent system. Here this information is passed on to elicit the production of specific antibodies and activation of cells for protection of the fish against pathogens.

Stress on an animal may compromise the functioning of the defense mechanisms. In the physiological pathways of the nonspecific and specific immune responses, steps that might be directly affected are those involved in initial inflammation, antigen recognition, or transportation of the anti-

Growth, Survival, and Vulnerability to Angling of Three Wild Brook Trout Strains Exposed to Different Levels of Angler Exploitation

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Abstract.—It has been suggested that the genetic growth potential of trout may be degraded over time by differential angler harvest of the faster-growing fish of each cohort. To test this hypothesis, young-of-the-year wild brook trout *Salvelinus fontinalis* from two branches of the Au Sable River and from the East Branch of the Fox River were stocked in three experimental Michigan lakes to determine their relative 2-year growth and survival. Brook trout populations from the Au Sable River are believed to have been exploited more intensively than the population from the East Branch of the Fox River. We found that brook trout from the East Branch Fox River grew significantly faster than fish from either the North Branch or the mainstream Au Sable River. The superior growth of East Branch Fox River brook trout was most evident in Hemlock Lake, where all strains grew best. Mature males were significantly longer and heavier than mature females when data were pooled across strains for each lake. East Branch Fox River mature females allocated relatively less energy to gonadal tissue than mature females of the Au Sable River strains. There were no significant differences in survival between the three brook trout stocks tested. A significantly higher percentage of the population of faster-growing East Branch Fox strain brook trout were caught from North Twin Lake by experimental angling than of either of the Au Sable River strains. The results of this study suggest that the intensity of angler exploitation, over time, may have altered the genetic potential for growth and catchability of these wild brook trout strains. It is also possible that founder stocks were genetically dissimilar or that genetic divergence resulted from differences in natural selection pressures between the study rivers. Although it could not be determined from this study why the growth and catch rates varied among the wild stocks tested, the documented differences provide information on stock performance that can be used by fisheries managers.

Biologists and anglers have hypothesized that the growth differences observed among populations of brook trout *Salvelinus fontinalis* may be due to genetic differences in their growth potential as well as to the productivity of their environment. It has been further suggested that the genetic growth potential of trout has been degraded over time by differential angler harvest of the faster-growing fish of each cohort, which leaves the slower growers to reproduce the stock. The impetus for this study is provided by the finding of Alexander (1987) that wild populations of brown trout *Salmo trutta* that were believed to have been exposed to high levels of size-selective exploitation grew more slowly than more lightly exploited stocks. Cooper (1952) showed that anglers differentially exploited faster-growing brook trout in Michigan's Pigeon River. Further evidence that growth and angler catchability are positively related was reported by Brauhn and Kincaid (1982) and Dwyer and Cooper (1984), who found that strains of rainbow trout *Oncorhynchus mykiss* genetically selected for faster growth were more vulnerable to angling than slower-growing domestic or wild rainbow trout

strains. The probability of angler capture also appears to increase with fish size for brown trout, largemouth bass *Micropterus salmoides*, and smallmouth bass *Micropterus dolomieu* (Favro et al. 1986; Burkett et al. 1986; Clapp and Clark 1989). Circumstantial evidence suggests that selective harvest of the faster-growing fish of a cohort in commercial or sport fisheries may reduce the genetic growth potential of fish stocks (Handford et al. 1977; Ricker 1981; Alexander 1987). Other possible evolutionary responses to size-selective exploitation include reductions in fish age and size at first reproduction (Kennedy 1953; Healey 1975; Handford et al. 1977). Modification of phenotypic variation by exploitation imposes the risk of a reduction of genotypic diversity, which in turn could result in a lower level of fitness (Kapuscinski and Lannan 1986).

The greater vulnerability to angling of brook trout compared with brown trout could theoretically result in more intense selection for slower growth. The primary purpose of the present study was to determine if wild brook trout from the East Branch Fox River, Michigan, that have been ex-

Ruhl rules Whitefish Derby

115 anglers turn out for benefit event

By Stephen Dodge
The Idaho Statesman

Whitefish quicker? Unroiled whitefish burgers? Whitefish proverbial?

Ryan Winters discovered a few things about whitefish Saturday afternoon: They can be filleted, smoked, stuffed or pickled. You can fry them, bake them and broil them.

But catch them? Well, after an afternoon of frustration, Winters was left fishing for answers on that one.

"I can't figure out where these stupid fish are," he said midway through the Boise River Whitefish Derby. "And you can't go to the deeper pools, because there are some real pigs up there."

Winters, who caught two fish, was referring to the anglers upriver, and not their prey. Some of the early fishers crowded into the deep pools to steal the best spots — and fished nearly elbow-

Derby finishers

Top three finishers in the Boise River Whitefish Derby, held Saturday.

Biggest fish: 1. Bryan Ruhl, 17½; 2. Tom Governoria, 16½; 3. Dwayne Speagle, 15½.

Most fish: 1. Karl Roberts, 50; 2. Ron Stockdale, 50; 3. Fred Hohno, 34.

to-elbow in some places.

The 116 entrants were fishing for prize, fun and to improve the reputation of the Roddley Dan, a small fish, often considered a trash fish, were said by many of the anglers to be quite tasty — although a couple admitted the trick is "to not taste them at all."

They even handed out recipes, including Whitefish Nuggets, and another recipe calling for (Quick! Call Peter Schott!) broiled whitefish with cherry butter.

Some of the winners were real pigs, and this is no longer a reference to the guy holding the rod

and reel. When Bryan Ruhl landed the winning fish (17½ inches), he stood on the bank screaming "It's a hog! It's a hog!"

Ruhl's handling of the monster was not exactly textbook.

"I was pretty excited," the Meridian resident said. "I started dragging it up toward the bank and then ran for it."

"I ended up sleeping on my line and breaking it, and I had to grab it out of the water with my hands."

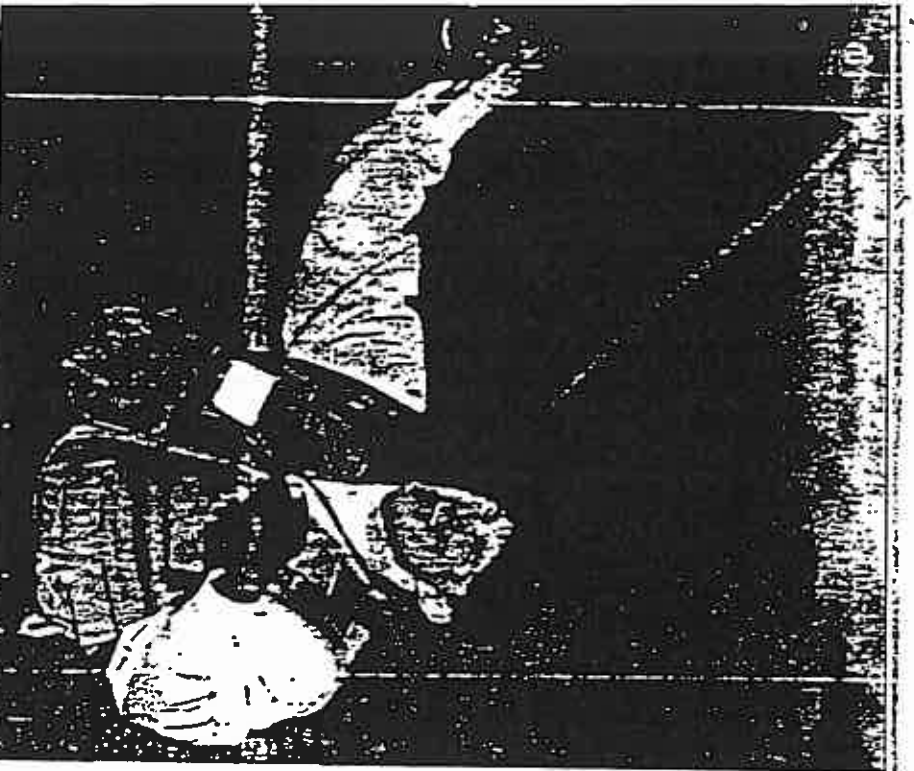
Then, according to friend Bill Donaldson, "he carried it around in front of him screaming."

Ruhl, who won a fly reel, thought he had a shot at the "most fish" title, too — but Kent Roberts beat him to it.

Roberts caught the 60th fish (the limit) in just under three hours, winning a fly rod. Most of his fish ran between 10 and 12 inches.

"I feel a little bit better," Roberts said. "Last year I fell down in the middle of the river. It was kinda fun to get out and fish a little — and not get wet."

Each angler paid a \$3 entry fee, with the money benefiting the Woolly Buggers — the Boise Valley Fly Fishermen's youth group.



Chile Butler/The Idaho Statesman
Butler while participating in the Boise River Whitefish Derby.

Idaho Statesman 11/21/95

FISHING IMPACT FACTS

1. Idaho's general fishing season runs from late May through November and all year around in some areas and for some species. Rainbow, brook and cutthroat trout spawn in late April through early June and eggs remain in the gravel another 4 to 7 weeks depending on water temperature. Bull and Brown trout spawn in October through November and eggs stay in the gravel all winter and hatch in the spring. Results: fishing is occurring during the majority of the fish reproduction cycle. (F&G Regulations and Handbook of Freshwater Fishery Biology)

2. Mortality of fish caught (and then released) with artificial lures ranges from 10.5% to 23.8% depending on hook size and fish species. Fish that bleed or are hooked in the gills have a 53% and 95.5% mortality rate respectively. (N. Am. J. Fish. Mgmt. 13:337) See exhibit.

3. The effects of stress on fish are manifest in three primary processes: mortality, growth, and reproduction. Although fish often appear to be healthy before, during, and immediately after a period of stress, a disease outbreak or chronic mortality may develop later. (AM. Fish. Soc. Sym. 8:80, 8:38 1990) See exhibit.

4. Wild trout (like the Bull Trout) have higher mortality rates because they attack and fight harder. (WA. F&G Mgmt. Div. Rep. by P.E. Mongillo 1984)

5. Twice daily wading during the egg fertilization to fry emergence stages killed up to 96% of the eggs and pre-emergent trout fry. Harvest and wading restrictions in combination would substantially improve fish populations. (N. Am. J. Fish. Mgmt. 12:454, 1992) See exhibit.

7. Fish caught in warmer temperatures have a lower survival rate. Mortality rates of trout caught with worm baited hooks are as high as 73%. (Prog. Fish-Culturist 32:231)

8. Stress can result in acute reproductive failure and in the gradual elimination of fish populations. (AM. Fish. Soc. Sym. 8:109) See exhibit.

9. Trout subjected to lower angler pressure grow faster and reach higher maximum weights and sizes. (N. Am. J. Fish. Mgmt. 14:423)

10. Trout subjected to high angler exploitation over time have altered genetic potential for growth and resultant negative genetic divergence resulting from differences in natural selection breeding processes. (N. Am. J. Fish. Mgmt. 14:423, 1994) See exhibit.

11. Negative effects to trout populations are correlated to human trampling of river riparian areas. (Am. Fish. Soc. Spec. Pub. 19:459, 1991)

12. The most important factors in the decline of the Priest Lake Cutthroat Trout are competition with introduced species, spawning taking, poaching and fishing pressure. (IDFG Dingell - Johnson Report Proj. F-24-R. pg. 176.)

13. Fly fisherman are considered "heros" for trampling fish nests and harverting scores of fish in a single day. (Idaho Statesman 1/21/95). See exhibit.

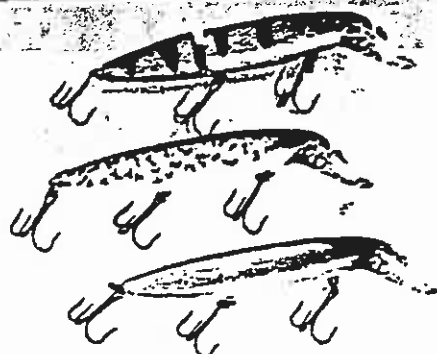
14. Fly fisherman conservation groups have removed streams from mineral entry and general fishing and have been allowed to dictate use to the public. (Ron Mackelprang 345-9360)

15. Mortatoria on fishing in Maryland restored fisheries. Conventional measures to reduce catch through size limits, seasons, gear limitations and daily catch limits failed to reverse fish population detoriation. (Fisheries, Vol. 18, No. 6, 1993)

16. Float boating and power boating may also affect listed species through disturbance of spawning adults or by physical disturbance of redds. Float boaters may step on redds as they push their boats over shallow riffle areas where listed salmon are likely to spawn. Jet boats passing over or in close proximity upstream from redds may increase intragravel pressure from high speed motors or disturb sediment which could settle out on eggs and reduce egg-to-fry survival. (Biological Opinion, PACFISH, NMFS, Mar. 1995)

DEADLY LURES FOR MUSKIES AND PIKE

Field Editor Joe Bucher, a top muskie-pike angler, hand-picked these lures to help you conquer various clear- or dingy-water conditions



KIT 1 CLEAR-WATER CRANKBAITS:

Straight-bodied DepthRaider (*crappie pattern*) for faster speeds and when working thicker cover. NEW Countdown model (*silver minnow*) that sinks about a foot a second to strain various depths. Jointed (*natural perch*) for shallower levels, over weed tops, night fishing, slower retrieves, less-active fish, open-water trolling and darker sides.

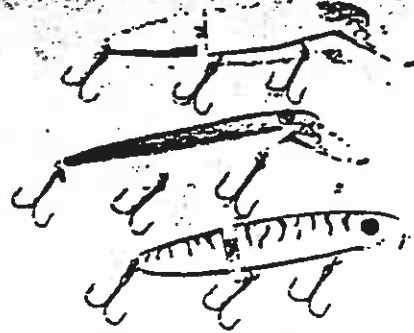


KIT 3 CLEAR-WATER BUCKTAILS: Many anglers consider the size 7 fluted blade (on two of these bucktails) the best and most versatile bucktail blade. It can be run just under the surface so it humps up the water for active shallower fish or at deeper levels. Willow-leaf blade on red/white Willow Buck offers less drag for deeper retrieves.

FREE \$4 VALUE with every crankbait kit - "DepthRaider Fishing Secrets" pamphlet and a 25-pack of super-strength (30-lb.-test) split rings.



FREE \$9 VALUE with every bucktail kit - Bucktail Fishing for Muskies book and 25-pack of super-strength (300-lb.-test) split rings.



KIT 2 DINGY-WATER CRANKBAITS:

Brighter, more visible patterns. Use straight-bodied DepthRaider (*chart-gold*) along deeper edges (drop-offs, weed lines, humps, etc.) and around heavier cover. Use jointed (*hot perch*) for slower speeds and at shallow running depths. Use ShallowRaider (*fire tiger*) over cover, along shallower edges, or when fish are up. Also makes an excellent twitch- or jerkbait.



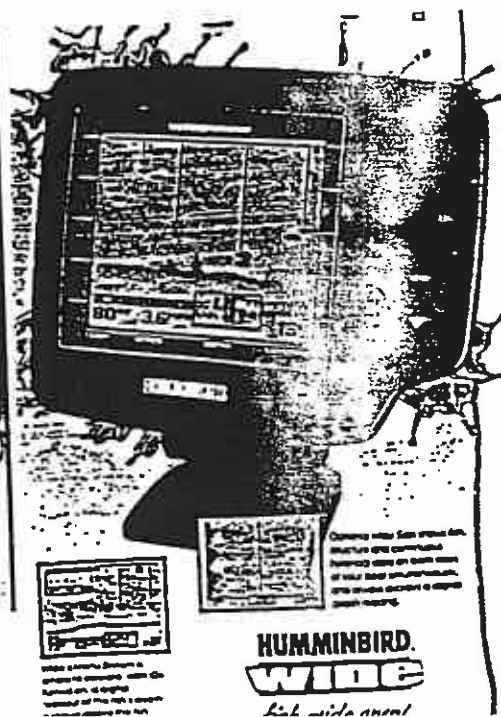
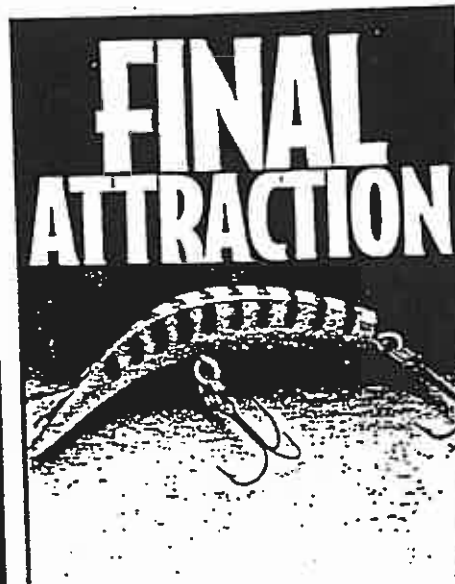
KIT 4 DINGY-WATER BUCKTAILS:

Almost 20 years of guiding has shown these patterns best for dingy or stained waters. Use rounded blades for more lift, willow leaf for faster, deeper retrieves and for a different blade bear. Quality construction to hold big fish.



VIDEO A: "Modern Musky Methods": Join Contributing Editor Jim Saric as he shows modern methods to catch muskies. Topics covered: mid-lake structures, hi-tech trolling, night fishing, using artificial/live bait combinations. Best muskie-teaching video we've seen! (\$19.95 + \$3.00 s&h)

VIDEO B: "Filleting Northerns": Anglers who know how to make pike filets boneless enjoy great eating. And you can easily learn to take the Y-bones out of pike, muskies or pickerel with Greg Bohn's supercut method. (\$9.95 + \$2.00 s&h)



HUMMINBIRD
WIDE
Fish wide area



A TREASURY OF KNOWLEDGE,

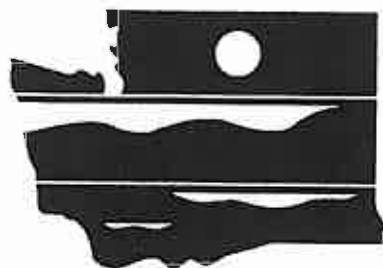
NEWS AND SKILLS FOR PEOPLE

WHO LOVE THE OUTDOORS



S

ome people say interest
in sportfishing is declining.
Yeah, right! Try to tell that to
this group of avid anglers.



WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y

March 2005

Publication No. 05-03-007

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Effects of Small-Scale Gold Dredging on Arsenic, Copper, Lead, and Zinc Concentrations in the Similkameen River

by

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March 2005

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A field study was conducted to determine if small-scale gold dredges operating in the Similkameen River exacerbate current exceedances of the human health criteria for arsenic or result in violations of aquatic life criteria for arsenic, copper, lead, or zinc. Dredge effluents were analyzed from 14 sites on the river, and discharge plumes were sampled below three dredges. Data were also obtained on ambient metals concentrations, total suspended solids, and turbidity.

Results showed that the metals concentrations discharged from small-scale gold dredges are not a significant toxicity concern for aquatic life in the Similkameen River. Although this activity will exacerbate exceedances of arsenic human health criteria, it would take very large numbers of dredges to effect a 10% change in the river's arsenic levels, even at low-flow conditions.

The authors of this report thank the many miners who gave permission to sample the effluent from their gold dredges. We very much appreciate the cooperation and friendly reception Ecology personnel received at the 2004 Gold Dredge Rally in Oroville. Special thanks to Jim Creegan for his efforts to help us obtain samples and to Mark Erickson and Greg Christensen of the Resources Coalition for their support and cooperation in the sampling effort at the rally.

The authors also would like to acknowledge the good work of staff at the Ecology Manchester Environmental Laboratory in analyzing the samples for this project, especially Dean Momohara, Meredith Jones, Aileen Richmond, Sara Sekerak, Jamie Martin, and Sally Cull.

Samples for this study were collected with the assistance of Chris Coffin, Ray Latham, and Terry Wittmeier of the Ecology Central Regional Office.

The Similkameen River is located in north-central Washington (Figure 1). During the public comment period on the *Lower Similkameen River Arsenic Total Maximum Daily Load* submittal report (Peterschmidt and Edmond, 2004), concerns were raised by the community and the Colville Confederated Tribes regarding the potential impact of small-scale gold dredging on arsenic concentrations in the river. An earlier laboratory simulation conducted by the Washington State Department of Ecology (Ecology) had concluded that arsenic and other metals would be rapidly diluted downstream of a dredge (Johnson, 1999). The applicability of these data to field conditions was called into question.

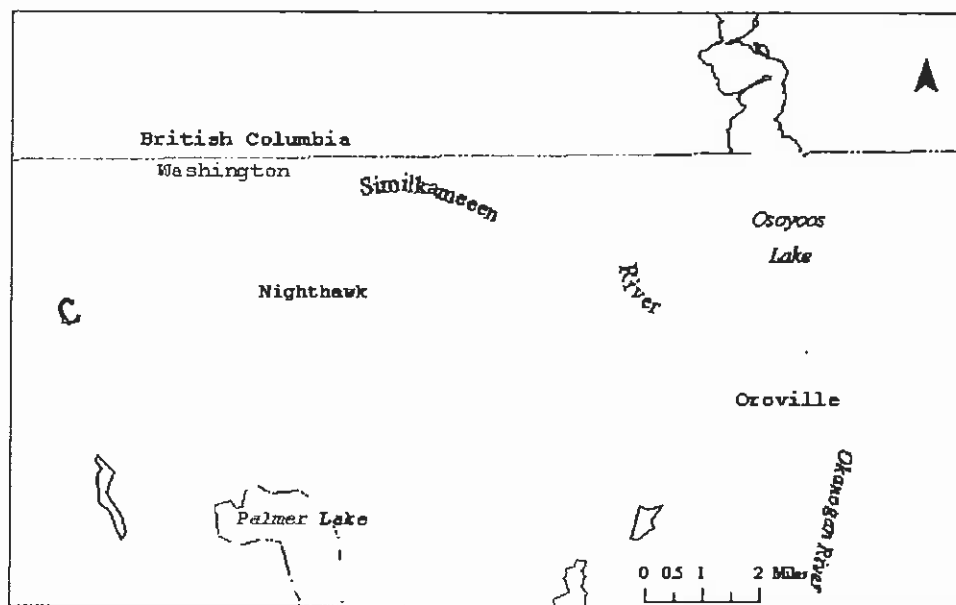


Figure 1. The Similkameen River

Dredging activities have been traditionally allowed on the Similkameen under mineral prospecting leases from the Washington State Department of Natural Resources (DNR). It is difficult to quantify the actual amount of dredging that occurs. The Ecology Central Regional Office (CRO) has observed up to 20 dredges on the river, although only some are in operation at any one time.

The dredging season is limited to July 1 through September 30, to protect salmon spawning. There are no restrictions on where dredging can be done along the length of the river. Dredging operations and high banking are limited to the wetted perimeter of the stream, or, with appropriate water rights, to within 200 feet inland of the ordinary high water mark.

The Washington Department of Fish and Wildlife (WDFW) is the lead agency regulating small-scale mining and prospecting. Their *Gold and Fish* pamphlet constitutes the Hydraulic Project

Approval (HPA) permit that small-scale prospectors and miners must comply with when conducting activities covered in the pamphlet. Exceptions to the pamphlet, authorization for other mining and prospecting activities, or use of other equipment types than authorized in *Gold and Fish* can be granted through issuance of a written HPA. Among other regulations, WDFW requires a minimum 200-foot separation between dredges. The role of Ecology in this activity is to administer water quality standards to prevent interferences with or harm to beneficial uses of state waters.

A typical commercially available dredge is pictured in Figure 2. A 4-inch diameter intake nozzle is the maximum currently allowed under authority of the *Gold and Fish* pamphlet and is most commonly used by small-scale prospectors and miners. Larger dredges can and have been permitted on the Similkameen River in the past.



Figure 2. A Small-scale Gold Dredge

(

).

Except for arsenic, the level of chemical contamination in Similkameen River sediments is relatively low, both for metals and organic compounds (Johnson and Plotnikoff, 2000; Colville Confederated Tribes, unpublished data). Appendix A has a summary of Ecology's sediment chemistry data for the Similkameen.

Arsenic concentrations generally range from 10 – 50 mg/Kg¹ (Figure 3). Samples in the vicinity of Nighthawk and Oroville have exceeded a recently proposed Washington state sediment quality guideline of 20 mg/Kg for protection of aquatic life (Avocet Consulting, 2003). Most Washington rivers and streams have less than 10 mg/Kg arsenic in their sediments (Johnson, 2002a).

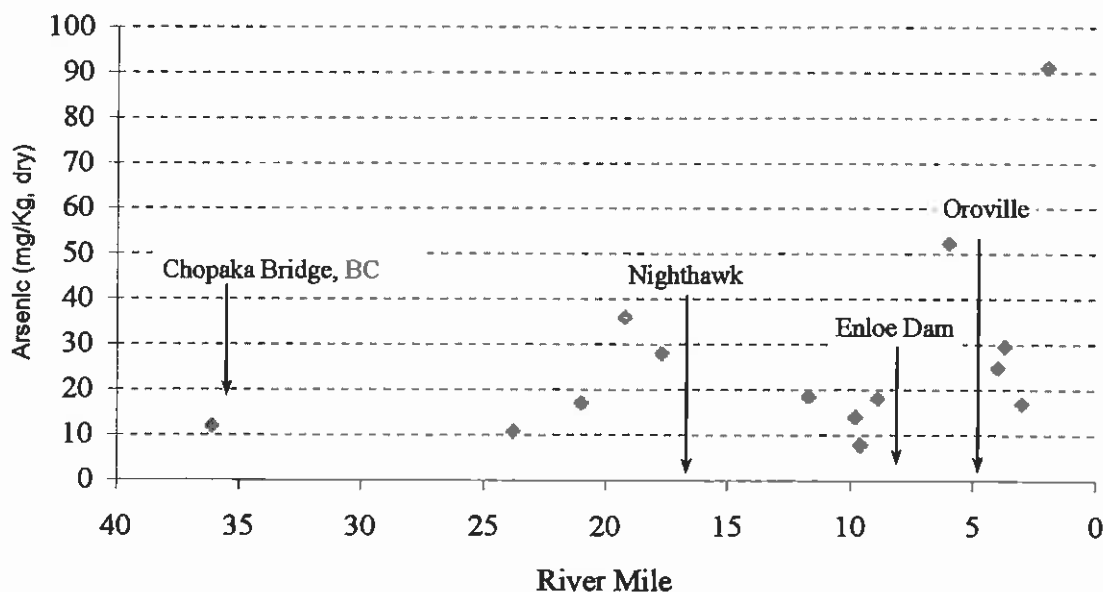


Figure 3. Arsenic Concentrations in Similkameen River Sediments (from Johnson, 2002a)

Arsenic is also elevated in the Similkameen water column, with concentrations of 1.0 - 5.0 ug/L² typically being encountered (Johnson, 2002a). Most Washington rivers have arsenic concentrations ranging from 0.2 – 1.0 ug/L (Johnson, 2002b). Other metals are not substantially elevated in the Similkameen River. Appendix B has Similkameen River metals data for 1995 - 2004 from Ecology's routine monitoring station at Oroville.

¹ mg/Kg = parts per million

² ug/L = parts per billion

A technical study conducted for the Similkameen River arsenic TMDL concluded that the major source of the higher arsenic concentrations was tailings from historical mining activity in British Columbia (Johnson, 2002a). Resuspension of contaminated sediments was identified as a potentially important source of arsenic to the water column.

Water quality criteria for metals being analyzed in the present study are shown in Table 1. Like most Washington rivers, the natural background concentration of arsenic in the Similkameen exceeds the very low human health criteria of 0.018 and 0.14 ug/L. Washington's human health criteria are from the EPA National Toxics Rule and are based on a one-in-one million excess cancer risk from consuming fish and water, or fish only. There are no equivalent human health criteria for copper, lead, or zinc. The aquatic life criteria shown below for arsenic, copper, lead, and zinc are not exceeded in the Similkameen River.

Table 1. Applicable Washington State Water Quality Criteria for Metals (ug/L)

Metal	Aquatic Life Criteria*		Human Health Criteria	
			Fish + Water Consumption	Fish Consumption
Arsenic	360	190	0.018 [†]	0.14 [†]
Copper**	9.2	6.5	--	--
Lead**	31	1.2	--	--
Zinc**	66	60	--	--

WAC 173-201A

*applies to dissolved metals

[†]applies to total inorganic arsenic

**criteria adjusted for 52 mg/L hardness (lowest recorded during present study)

Arsenic has been shown to increase going downstream from Chopaka, B.C. (river mile 36) to Oroville (Figure 4). This is primarily due to the Palmer Lake outlet at r.m. 19.5, a major arsenic source to the lower river. Palmer Lake has been contaminated by inflows from the Similkameen River and may have additional local sources of arsenic. (Johnson, 2002)

The previously mentioned dredging simulation study conducted by Ecology involved mixing predetermined amounts of Similkameen River water and sediment to approximate a dredged material slurry (the Elutriate Test described in Plumb (1981)). After shaking for 30 minutes, the supernatant from the mixture was allowed to settle, then filtered and analyzed. The samples used in this test were obtained near Eagle Rock (r.m. 11.7) and just above Enloe Dam (r.m. 8.9), areas where dredging was either underway or planned. Arsenic concentrations were 14 - 18 mg/Kg in the bulk sediments and 3.9 ug/L in the river water.

Results of the simulation showed that arsenic, copper, lead, and zinc were the metals of primary interest. Arsenic concentrations in the elutriate were 5 - 10 times higher than the river water used in the test. Copper and lead exceeded aquatic life criteria by factors of 2 - 4. Zinc approached half its aquatic life criteria values. A point source dilution model applied to these

data suggested that at least a five-fold dilution would occur immediately downstream of a dredge during low-flow conditions. It was concluded that water quality concerns were probably negligible for metals, at least with respect to individual dredges.

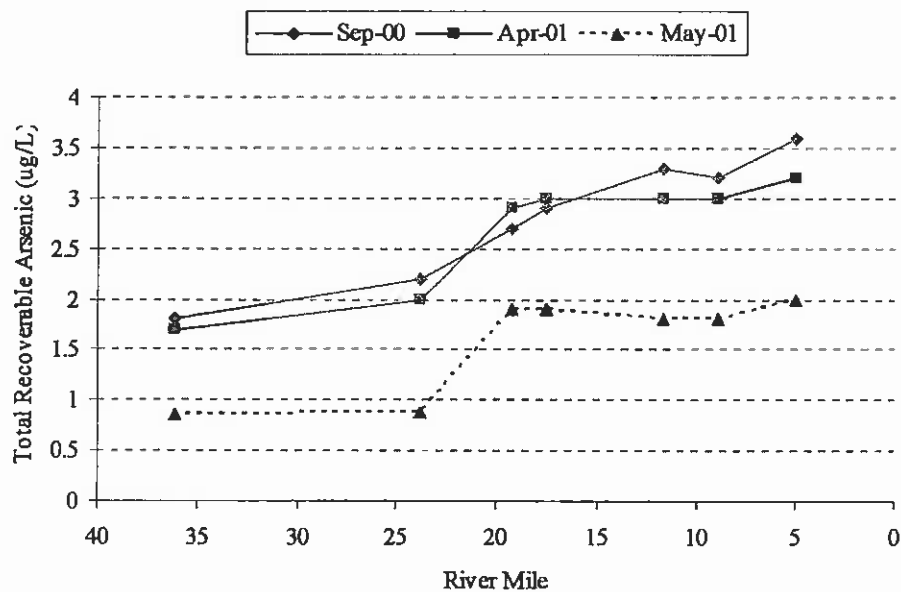


Figure 4. Arsenic Concentrations in Similkameen River Water Samples (from Johnson, 2002a).

In response to the concerns expressed by the community and Tribe, Ecology conducted a field study to obtain water samples in the vicinity of small-scale gold dredges operating in the Similkameen River during the summer of 2004. The objectives of the study were to determine if dredging: 1) exacerbates current exceedances of the human health criteria for arsenic, or 2) results in violations of the aquatic life criteria for arsenic, copper, lead, or zinc. The study was not designed to assess compliance with the state turbidity standard or to determine the effect of dredging on total suspended solids (TSS) concentrations in the river.

Three types of water samples were collected for the study: Ambient samples were collected in the upper river to determine background concentrations for the metals and other parameters of interest. Effluents were sampled from dredges operating at 14 sites along the river to represent a range of substrates and associated metals concentrations. Finally, the turbidity plumes downstream of three dredges were sampled at selected distances to gauge the downstream extent of the impacted area.

Clean sampling techniques and low-level analytical methods were used to analyze arsenic, copper, lead, and zinc. TSS, turbidity, and hardness were also measured. Hardness was needed to calculate the water quality criteria for copper, lead, and zinc. Some data were also obtained on effluent flow rates and stream velocities in the vicinity of the dredges. River discharge was determined from the gaging station operated by the U.S. Geological Survey (USGS) at Nighthawk (<http://nwis.waterdata.usgs.gov/usa/nwis/discharge>).

Field work was conducted once each month during the July 1 – September 30 period when dredging is permitted. The study was conducted by the Ecology Environmental Assessment Program with field assistance provided by CRO. The samples were analyzed by the Ecology Manchester Environmental Laboratory.

Samples for the gold dredge study were collected on June 30 - July 1, August 18 - 19, and September 21 - 22, 2004. Monthly average river flow during this period typically ranges from 3,029 cfs (July) to 616 cfs (September).

The first set of samples corresponded to the July 1 opening of the mineral prospecting work window. The second sample set was collected during a Resources Coalition dredge rally held in Oroville on August 18 - 22, an event designed to generate interest and improve understanding of small-scale gold dredging. The third sample set was intended to assess dredging impacts during September low flow.

Ambient Samples

Background concentrations for the metals and other parameters of interest were determined by analyzing water samples collected in the Similkameen River approximately 3 ½ miles below Nighthawk (Figure 5). This location is in the upper part of the reach where most dredgers work. The ambient samples were collected on June 30, the day before the opening of the dredging season, and again in the early morning of August 19 and September 22 before dredgers began working the river.

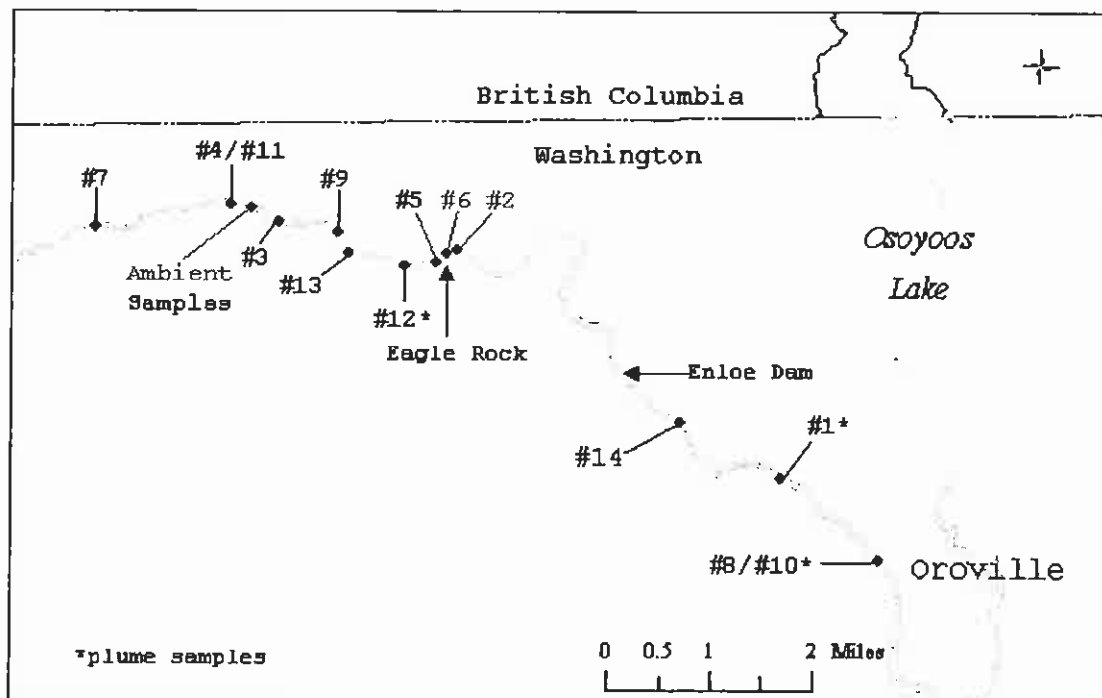


Figure 5. Locations of Gold Dredge Samples Collected in the Similkameen River during 2004

Three replicate samples were collected on each of the above dates and analyzed for total recoverable³ and dissolved arsenic, copper, lead, and zinc, turbidity, and hardness. In addition to establishing background conditions, the results provided information on particulate vs. dissolved metals which was needed to evaluate the effluent data.

Effluent Samples

Dredging primarily occurs from a few miles below Nighthawk (r.m. 17.5) down to Oroville near the mouth of the river. Dredges operating at the 14 sites shown in Figure 5 were opportunistically sampled. An attempt was made to distribute the sampling effort equally up and down the river. No samples were obtained in the reservoir behind Enloe Dam as dredges normally do not operate there.

A single sample was collected from each dredge at the point the discharge left the sluice box. For dredge operations where the turbidity plume was being sampled, three effluent samples were collected.

In an effort to obtain a representative time-dependent composite, the effluent samples were collected by filling a one-liter sample bottle in small increments over a five-to-ten minute period. The samples were allowed to settle for approximately one hour and then ½ liter decanted into sample containers. This procedure removed sand and other large particles that would normally settle out of the water column. A settling time of one hour was selected based on the settleable solids analysis in EPA Method 160.5.

The effluents were analyzed for total recoverable arsenic, copper, lead, and zinc.

For selected dredges, the effluent flow rate was estimated from discharge velocity measurements and the dimensions of the sluice box. River velocity and substrate characteristics were also recorded.

Detailed information on the location of the effluent sampling sites, dredge descriptions, flows, and substrate characteristics can be found in Appendix C.

Plume Samples

The plumes from three dredges operating under different flow regimes – one each in July, August, and September – were sampled to gage the downstream extent of the impacted area (Figure 5). Three samples each were collected at 10, 50, and 200 feet below the dredge, staggered over approximately a 30-minute period. A marked polyethylene line with a float at the far end was attached to the back of the dredge to locate downstream sampling points. The distance of the furthest downstream sample was based on the *Gold and Fish* pamphlet requirement that dredges be separated by 200 feet.

³ Total recoverable metals refers to a laboratory procedure where a sample is subjected to strong acid digestion prior to analysis. A total metals analysis employs a more thorough digestion of the sample. A total recoverable analysis is typically done for surface water samples and, for present purposes, is essentially equivalent to total metals.

Three separate effluent samples were collected at the same time the plume was being sampled. A single sample was also collected immediately upstream of the dredge suction hose for comparison with the plume. The effluent was analyzed for total recoverable metals.

The upstream and plume samples were analyzed for total recoverable arsenic, dissolved copper, lead, and zinc, TSS, turbidity, and hardness. Arsenic was analyzed as total recoverable for comparison to the human health standards, which are based on inorganic arsenic. Most of the arsenic in the Similkameen River water is in inorganic form (Johnson, 2002a). Measuring inorganic arsenic directly would have significantly increased the cost of the study. Total recoverable arsenic can reasonably be compared to the dissolved aquatic life criteria, since they differ only slightly from the older total recoverable criteria on which they are based. Copper, lead, and zinc were analyzed as dissolved for direct comparison with the aquatic life standards.

Number of Samples

The number and type of samples collected for this project are summarized in Table 2.

Table 2. Number and Type of Samples Collected for the 2004 Similkameen River Gold Dredge Study

Sample Type	No. of Sites	Samples per Site	Sub-total	Analyses
Ambient River	1	9	9	TR As, Cu, Pb, Zn; Diss Cu, Pb, Zn; TSS; turbidity; hardness
Above Dredge	14	1	14	TR As; Diss Cu, Pb, Zn; TSS; turbidity; hardness
Dredge Effluent	14	1-3	20	TR As, Cu, Pb, Zn
Dredge Plume	3	9	27	TR As; Diss Cu, Pb, Zn; TSS; turbidity; hardness
Bottle Blanks	1	3	3	TR As, Cu, Pb, Zn
Filter Blanks	1	3	3	Diss As, Cu, Pb, Zn
Total =			76	

TR = total recoverable

Diss = dissolved

Field Procedures

Table 3 lists the sample size, container, preservation, and recommended holding time for each study parameter. Sample containers were obtained from Manchester Laboratory. Metals sampling procedures followed the guidance in EPA (1995) *Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*. All samples were taken as simple grabs or grab composites.

Table 3. Sample Containers, Preservation, and Holding Times for Water Samples

Parameter	Minimum Quality Required	Container	Preservative*	Holding Time
Metals	250 mL	500 mL Teflon bottle	HNO ₃ to pH<2, 4°C	6 months
Hardness	100 mL	125 mL poly bottle	H ₂ SO ₄ to pH<2, 4°C	6 months
TSS	1,000 mL	1,000 mL poly bottle	Cool to 4°C	7 days
Turbidity	100 mL	500 mL poly bottle	Cool to 4°C	48 hours

*dissolved metals samples filtered in the field (0.45 micron)

Metals samples were collected directly into pre-cleaned 500 mL (plume and ambient samples) or 1 L (effluent samples) Teflon bottles. The effluent samples were allowed to settle and were then decanted, as previously described. Samples for dissolved metals were filtered in the field through a pre-cleaned 0.45 µm Nalgene filter unit (#450-0045, type S). The filtrate was transferred to a new pre-cleaned 500 mL Teflon bottle. The whole water and filtered water samples were preserved to pH <2 with sub-boiled 1:1 nitric acid, carried in small Teflon vials. Teflon sample bottles, Nalgene filters, and Teflon acid vials were cleaned by Manchester, as described in Kammin et al. (1995), and sealed in plastic bags. Non-talc nitrile gloves were worn by personnel filtering the samples. Filtering was done in a glove box constructed of a PVC frame and polyethylene cover.

Flow was measured with a Marsh-McBirney meter and top-setting rod. A hand-held GPS was used to record sampling locations. All samples were placed in polyethylene bags, held on ice for transport to Ecology HQ, and then taken by courier to Manchester Laboratory within one to two days of collection. Chain-of-custody procedures were followed (Manchester Environmental Laboratory, 2003).

Laboratory Procedures

Table 4 shows the analytical methods used in this project.

Table 4. Laboratory Procedures

Analyte	Sample Matrix	Sample Prep Method	Analytical Method
Arsenic, Copper, Lead, Zinc	whole water	HNO ₃ /HCl digest	EPA 200.8
Copper, Lead, Zinc	filtered water	analyze directly	EPA 200.8
Hardness	whole water	N/A	EPA 200.7
TSS	whole water	N/A	EPA 160.2
Turbidity	whole water	N/A	EPA 180.1

N/A = not applicable

Manchester Laboratory prepared written quality assurance reviews on the quality of the chemical data for this project. The reviews include an assessment of sample condition on receipt at the laboratory, compliance with holding times, instrument calibration, procedural blanks, laboratory control samples, matrix spike and matrix spike duplicate recoveries, and duplicate sample analyses. No significant problems were encountered that compromise the accuracy, validity, or usefulness of the data. The quality assurance reviews and complete chemical data for this project are available from the author.

The precision of the data reported here can be assessed from results of duplicate analyses conducted on selected samples (Appendix D). Dissolved metal determinations agreed within 10%. Total recoverable metals agreed within approximately 20%, except 36% for zinc in one sample. Results for TSS, turbidity, and hardness were also in close agreement.

Field blanks were analyzed to detect metals contamination arising from sample containers or the filtration procedure. Bottle blanks were prepared at Manchester Laboratory by filling the Teflon sample bottles with deionized water. Filter blanks were prepared by filtering half the contents of a bottle blank. The field blanks were treated the same as samples.

Bottle and filter blanks were analyzed on three occasions during the project (Appendix E). There was a trace amount of zinc in the filter blanks (0.56 – 1.1 ug/L). The other metals were not detected in either type of blank. This demonstrates that the sample collection, preservation, and filtration procedures were not contributing significant amounts of metals to the samples.

River Flow

Figure 6 compares historical average flow in the Similkameen River with the flows encountered when samples were collected for the 2004 gold dredge study. The data are from USGS monitoring station #12442500 at Nighthawk.

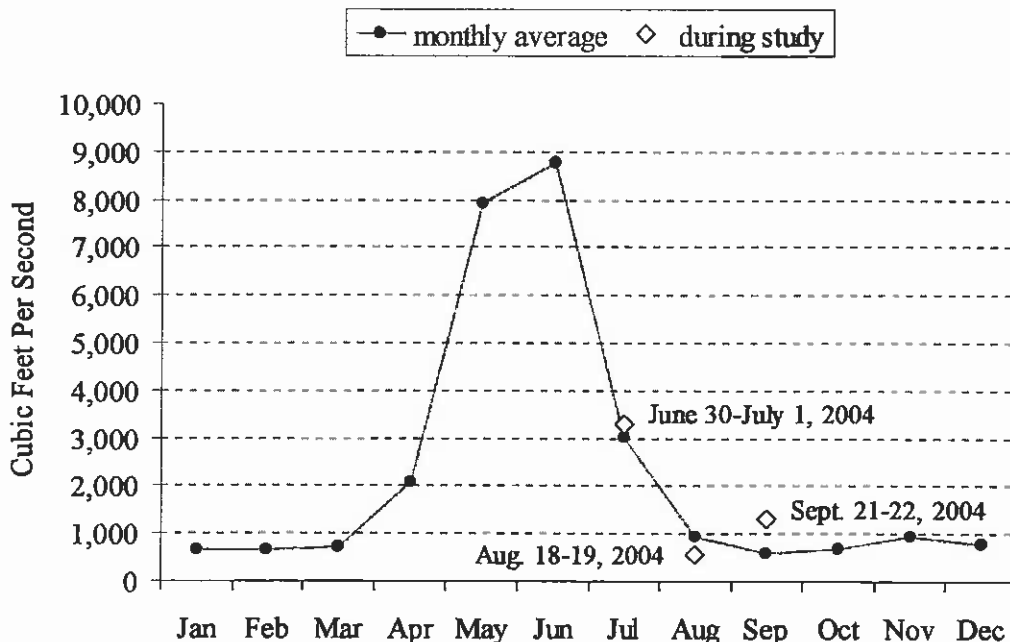


Figure 6. Monthly Average Flow in the Similkameen River, Showing Flows When Gold Dredge Samples were Collected (USGS station 12442500, 1928 – 2002).

As shown in Figure 6 and summarized below, river flows during gold dredge sampling were representative of the range of summer flows normally encountered in the Similkameen. Dry August weather resulted in low-flow conditions that were not anticipated to occur until the following month. Wet weather caused higher than normal discharge during the September sample collection.

Month	Average Flow	
	Historical	During Sampling
July	3,029 cfs	3,300 cfs
August	936 cfs	581 cfs
September	616 cfs	1,320 cfs

Ambient Water Quality

Ambient levels of TSS, turbidity, metals, and hardness measured in the Similkameen during the 2004 dredging season are summarized in Table 5. As previously described, these samples were collected in the upper part of the reach where dredging is done, but when no dredges were operating. Each data point represents results from three replicate samples. Variability within each sample set was minimal.

Table 5. Ambient Water Quality Conditions in the Similkameen River During the 2004 Gold Dredging Season [mean \pm standard deviation of three replicates collected at river mile 14.0; no dredges operating]

Parameter	June 30	August 18	September 21	Overall Mean*
TSS (mg/L)	10 \pm 0	3 \pm 0.5	5 \pm 0	6
Turbidity (NTU)	4.2 \pm 0.4	2.2 \pm 0.1	2.4 \pm 0.05	2.9
Tot. Rec. Arsenic (ug/L)	3.9 \pm 0.1	4.2 \pm 0	2.2 \pm 0.1	3.4
Dissolved Arsenic (ug/L)	2.7 \pm 0.1	4.2 \pm 0	1.8 \pm 0	2.9
Tot. Rec. Copper (ug/L)	2.3 \pm 0.2	1.2 \pm 0	1.4 \pm 0	1.6
Dissolved Copper (ug/L)	0.82 \pm 0.05	0.84 \pm 0.01	0.97 \pm 0.1	0.88
Tot. Rec. Zinc (ug/L)	1.7 \pm 0.1	<1.0	1.2 \pm 0.1	1.3
Dissolved Zinc (ug/L)	0.92 \pm 0.1	1.1 \pm 0.1	2.2 \pm 1.5	1.4
Tot. Rec. Lead (ug/L)	0.14 \pm 0.02	<0.10	0.18 \pm 0.01	0.14
Dissolved Lead (ug/L)	<0.02	<0.10	0.09 \pm 0.05	0.07
Hardness (mg/L)	52 \pm 0.4	82 \pm 0.1	61 \pm 0.02	65

*detection limit used for non-detects

TSS, turbidity, and total recoverable zinc, copper, and lead varied directly with flow. The levels were highest in July (September for lead) and lowest in August. The highest total recoverable arsenic concentrations were in August. Hardness varied inversely with flow, reflecting the relatively greater contribution of groundwater when river discharge is low.

TSS and turbidity ranged from 3 - 10 mg/L and 2.2 - 4.2 NTU, respectively. Concentrations of total recoverable metals ranged from 2.4 - 4.2 ug/L for arsenic, 1.2 - 2.3 ug/L for copper, <1.0 - 1.7 ug/L for zinc, and <0.10 - 0.18 ug/L for lead. Total recoverable zinc and lead were below detection limits during the low flows of August.

Dissolved metals concentrations were 1.8 - 4.2 ug/L for arsenic, 0.82 - 0.97 ug/L for copper, 0.92 - 2.2 ug/L for zinc, and <0.02 - 0.09 ug/L for lead. Because of a zinc background in the filtration procedure, the dissolved results slightly exceeded total recoverable in most of the August and September samples. Trace zinc contamination is frequently encountered when analyzing at the low ppb level.

These results are consistent with historical data on the Similkameen River (Appendix B; Johnson 1997, 2002a). At the time of the gold dredge study, ambient levels of dissolved arsenic, copper, lead, and zinc were one to two orders of magnitude lower than the aquatic life criteria (see Table 1). Total recoverable arsenic exceeded the more restrictive human health criteria by one to two orders of magnitude. As discussed earlier in this report, arsenic concentrations in most rivers and streams naturally exceed the EPA human health criteria, although to a lesser extent than in the Similkameen. There are no human health criteria for copper, lead, or zinc.

Dredge Effluents

Metals concentrations measured in effluents from gold dredges operating in the lower Similkameen River are shown in Table 6. These data are for total recoverable metals.

Table 6. Metals Concentrations in Effluent Samples from Gold Dredges Operating in the Similkameen River During 2004 [ug/L, total recoverable]

Site No.	Date	Arsenic	Copper	Zinc	Lead
#1	July 1	3.8	2.3	1.9	0.23
#2	July 1	6.2	6.1	5.2	0.69
#3	August 18	6.4	4.7	9.1	0.67
#4	August 18	6.6	9.3	9.4	0.97
#5	August 18	6.6	8.3	7.3	1.1
#6	August 18	6.3	5.1	4.2	1.3
#7	August 18	4.6	2.4	1.8	0.16
#8	August 18	7.4	4.4	3.3	0.47
#9	August 19	5.6	3.3	3.0	0.39
#10	August 19	7.3	3.7	4.4	0.46
#11	August 19	8.0	5.4	7.4	0.75
#12	September 21	2.6	2.9	2.0	0.47
#13	September 21	3.3	4.7	3.6	0.62
#14	September 22	2.6	2.0	1.8	0.26
mean =		5.5	4.6	4.6	0.61
minimum =		2.6	2.0	1.8	0.16
maximum =		8.0	9.3	9.4	1.3

Although collected at 14 different locations and at varying stages in the dredging process, metals concentrations in the effluents did not differ greatly between sites. Minimum and maximum concentrations were within a factor of 2 for arsenic, factors of 4 - 5 for copper and zinc, and a factor of 8 for lead. Average concentrations were 5.5 ug/L arsenic, 4.6 ug/L copper, 4.6 ug/L zinc, and 0.61 ug/L lead. As described earlier, these samples were decanted, so did not include sand and other particles that would rapidly settle out of the water column following discharge.

Most of the effluent data are based on single samples composited over a five-to-ten minute period. Three separate composites were analyzed in conjunction with turbidity plume sampling at sites #1, #10, and #12. These samples were collected over a period of approximately 30 minutes (i.e., three five-to-ten minute composites per site) and also showed a low level of variability (Table 7). The average of the three composites is shown in Table 6.

Table 7. Variability of Replicate Gold Dredge Effluent Samples [ug/L, total recoverable]

Site No	Date	Time	Arsenic	Copper	Zinc	Lead
#1	July 1, 2004	115-1125	5.0	2.5	1.9	0.26
"	"	1335-1345	3.2	2.3	2.1	0.21
"	"	1155-1205	<u>3.3</u>	<u>2.2</u>	<u>1.6</u>	<u>0.23</u>
		mean \pm s.d.=	3.8 \pm 0.8	2.3 \pm 0.1	1.9 \pm 0.2	0.23 \pm 0.02
#10	Aug 18, 2004	1513-1518	7.1	3.2	3.8	0.41
"	"	1523-1528	7.8	4.9	5.5	0.58
"	"	1538-1543	<u>7.0</u>	<u>3.0</u>	<u>3.9</u>	<u>0.38</u>
		mean \pm s.d.=	7.3 \pm 0.4	3.7 \pm 0.9	4.4 \pm 0.8	0.46 \pm 0.1
#12	Sept 21, 2004	1330-1335	2.6	2.9	2.1	0.56
"	"	1338-1343	2.7	3.2	2.0	0.48
"	"	1345-1350	<u>2.5</u>	<u>2.6</u>	<u>1.9</u>	<u>0.38</u>
		mean \pm s.d.=	2.6 \pm 0.1	2.9 \pm 0.2	2.0 \pm 0.1	0.47 \pm 0.1

A perspective on the potential these effluents have to affect metals concentrations in the river can be gained from a comparison with the ambient data (Figure 7). Zinc and lead appear to be the metals of greatest potential concern, with effluent concentrations being up to approximately 10 times higher than ambient levels. Arsenic, on the other hand, exceeded background by a factor of 2 or less, suggesting a minimal impact. These data indicate that the potential for these metals to be increased due to dredging in the Similkameen River is, in decreasing order, zinc, lead, copper, and arsenic.

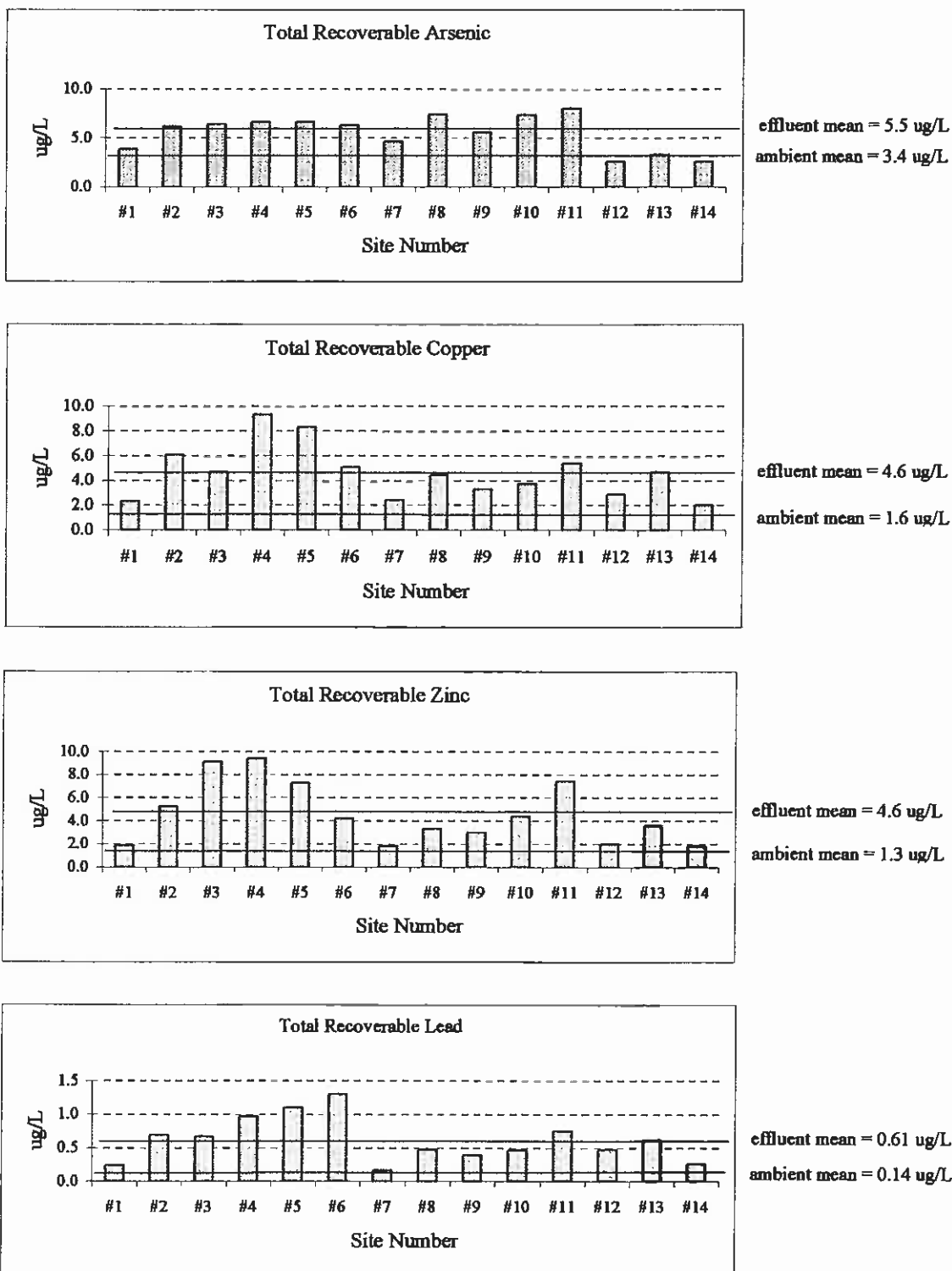


Figure 7. Metals Concentrations in Similkameen River Gold Dredge Effluents

Dredge Plumes

Turbidity plumes were sampled behind three gold dredges, one each at sites #1, #10, and #12. The results are summarized in Table 8. Each data point represents results from three replicate samples taken over approximately a 30-minute period. The effluent data are for total recoverable metals, while the plume and upstream data are for dissolved metals, except for total recoverable arsenic. (See Study Design for an explanation of analyzing total recoverable vs. dissolved metals.)

Table 8. Results from Sampling Gold Dredge Effluent Plumes in the Similkameen River During 2004 [mean \pm standard deviation of three samples, except a single sample collected above each dredge]

Parameter	Turbidity (NTU)	TSS (mg/L)	Diss. Zinc (ug/L)	Diss. Copper (ug/L)	Diss. Lead (ug/L)	T.R. Arsenic (ug/L)	Hardness (mg/L)
Site #1, July 1							
Above dredge	4.3	10	<0.50	1.0	<0.02	3.7	52
Dredge effluent*	N/A	N/A	1.9 \pm 0.2	2.3 \pm 0.1	0.23 \pm 0.02	3.8 \pm 0.8	N/A
10 ft. downstream	10 \pm 3.0	86 \pm 45	1.1 \pm 0.2	0.83 \pm 0.02	<0.02**	9.8 \pm 5.1	54 \pm 1
50 ft. downstream	7.6 \pm 3.0	68 \pm 23	1.1 \pm 0.2	0.83 \pm 0.02	<0.02 [†]	9.4 \pm 5.4	54 \pm 2
200 ft. downstream	5.2 \pm 1.0	20 \pm 3	0.6 \pm 0.1	0.87 \pm 0.09	<0.02	5.0 \pm 0.7	53 \pm 0.1
Site #10, August 18							
Above dredge	0.8	1	0.68	0.76	<0.10	5.3	88
Dredge effluent*	N/A	N/A	4.4 \pm 0.8	3.7 \pm 0.8	0.46 \pm 0.09	7.3 \pm 0.4	N/A
10 ft. downstream	12 \pm 0.5	32 \pm 7	2.0 \pm 0.7	0.86 \pm 0.01	<0.10	9.8 \pm 1.9	90 \pm 0.3
50 ft. downstream	3.6 \pm 1.0	7 \pm 2	1.3 \pm 0.1	0.81 \pm 0.01	<0.10	6.0 \pm 0.1	89 \pm 0.4
200 ft. downstream	1.4 \pm 0.2	3 \pm 0.5	1.1 \pm 0.2	0.81 \pm 0.01	<0.10	5.4 \pm 0	88 \pm 0.3
Site #12, September 21							
Above dredge	3.0	7	<0.50	0.94	0.032	2.2	59
Dredge effluent*	N/A	N/A	2.0 \pm 0.08	2.9 \pm 0.2	0.47 \pm 0.07	2.6 \pm 0.1	N/A
10 ft. downstream	11 \pm 0.5	44 \pm 9	0.88 \pm 0.1	0.99 \pm 0.01	0.039 \pm 0.001	4.0 \pm 0.4	60 \pm 0
50 ft. downstream	6.9 \pm 0.1	23 \pm 3	2.8 \pm 0.9	1.1 \pm 0.1	0.040 \pm 0.003	2.8 \pm 0.1	59 \pm 0
200 ft. downstream	4.0 \pm 0.9	8 \pm 2	0.93 \pm 0.3	0.94 \pm 0.01	0.035 \pm 0.002	2.4 \pm 0.1	59 \pm 0

N/A = not analyzed

*dredge effluent data are total recoverable metals

**one detection at 0.028 ug/L

[†]one detection at 0.027 ug/L

River flows at the time of sample collection were 3,300 cfs (site #1), 581 cfs (site #10), and 1,320 cfs (site #12). Current velocities at the dredge sites ranged from 1.5 to 2.5 feet per second, and water depths were between 1.5 and 4 feet. The substrates were cobble with varying amounts of sand and gravel.

Downstream changes in the plume can be better visualized in Figure 8 which plots average TSS, turbidity, and metals concentrations. Zinc was below detection limits in the August and September upstream samples, and lead was below detection limits in most of the July and August samples. The detection limit was plotted where these metals were not detected.

Table 9 compares the upstream TSS, turbidity, and metals concentrations with the average concentrations measured in the furthest downstream samples 200 feet below the dredge. The differences between the three sites illustrate the variability inherent in a dredge plume mixing under different conditions of river flow and turbulence.

Table 9. Percent Increases in TSS, Turbidity, and Metals Concentrations Measured 200 Feet Below Three Gold Dredges in the Similkameen River

Site No.	TSS (mg/L)	Turbidity (NTU)	Tot. Rec Arsenic (ug/L)	Dissolved Copper (ug/L)	Dissolved Zinc (ug/L)	Dissolved Lead (ug/L)
#1	100	21	35	0	20	ND
#10	200	75	2	7	62	ND
#12	<u>14</u>	<u>33</u>	<u>9</u>	<u>0</u>	<u>86</u>	<u>9</u>
mean =	100	43	15	2	56	9

ND = not detected

At 200 feet, complete mixing with the river had not occurred. On average, TSS concentrations 200 feet downstream of the dredges were twice as high (100% increase) as upstream of the dredges. Turbidity and dissolved zinc levels at 200 feet were half again as high as upstream (43 – 56% average increase). There was only a modest increase in arsenic, copper, and lead (2 – 15%).

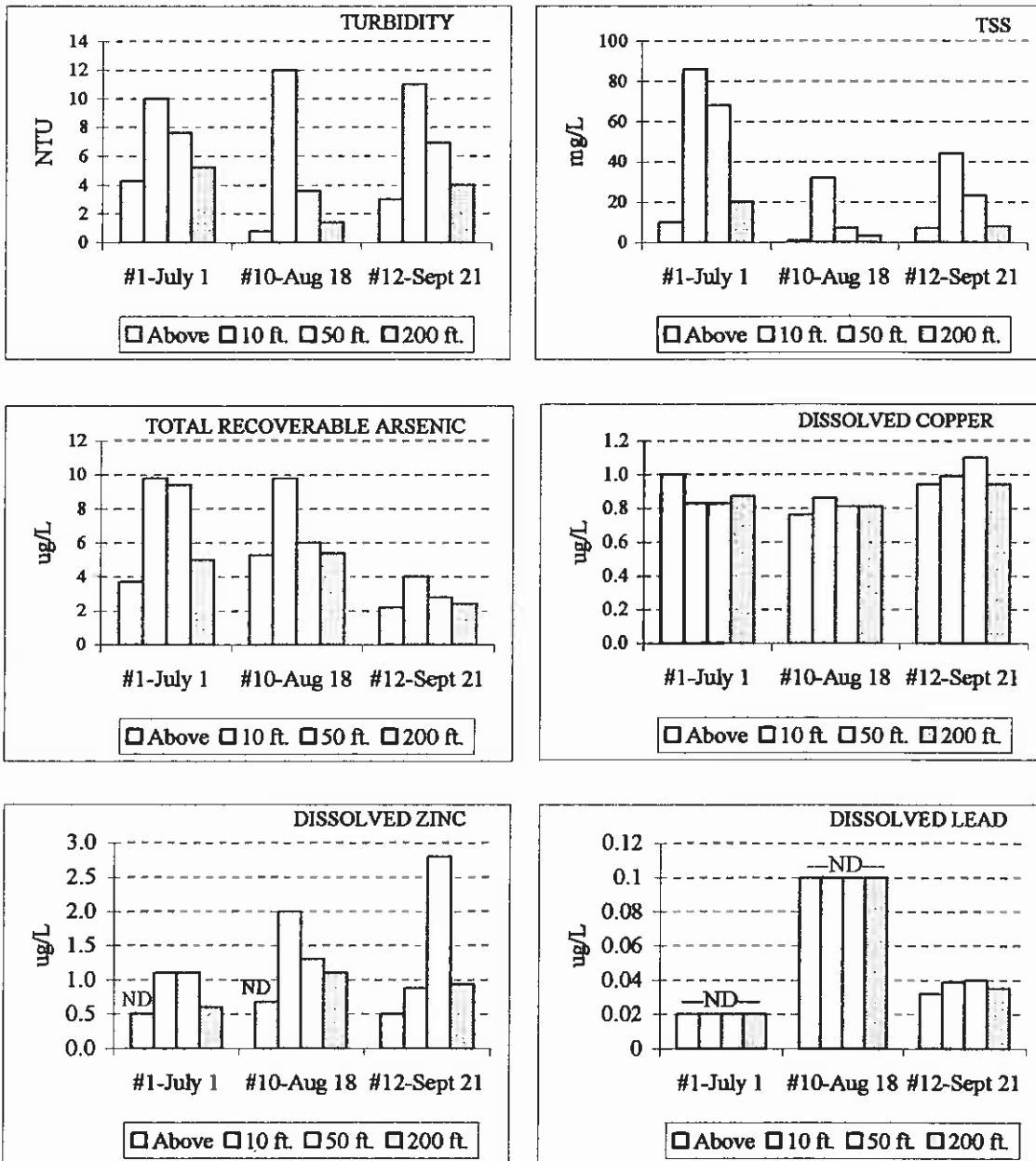


Figure 8. TSS, Turbidity, and Metals Concentrations Below Three Gold Dredges in the Similkameen River (mean of three grabs; ND = not detected).

Comparison with Water Quality Criteria

Table 10 compares the metals concentrations measured in Similkameen gold dredge effluents and dredge plumes with Washington state criteria for the protection of aquatic life. Copper, lead, and zinc toxicity varies inversely with hardness. The criteria were calculated for a hardness of 52 mg/L, the lowest recorded in the study.

Table 10. Metals Concentrations in Similkameen River Dredge Effluent and Plume Samples Compared to Criteria for Protection of Aquatic Life (ug/L)

	Arsenic	Copper	Lead	Zinc
Concentration Range in Effluents* (n=18)	2.6 - 8.0	2.0 - 9.3	0.16 - 1.3	1.8 - 9.4
Concentration Range Measured in Plume† (n=27)	2.3 - 17	0.79 - 1.2	<0.02 - 0.043	<0.5 - 4.1
Acute water quality criterion**	360	9.2	31	66
Chronic water quality criterion**	190	6.5	1.2	60

*total recoverable metals

†dissolved metals except total recoverable arsenic

**dissolved metals at 52 mg/L hardness (lowest recorded in study)

Based on analyzing 14 effluents and 27 plume samples, it appears that small-scale gold dredges have little or no potential to cause exceedances of aquatic life criteria in the Similkameen River. Arsenic and zinc concentration in dredge related samples were one to two orders of magnitude lower than criteria. Copper and lead concentrations were at or below criteria, except for one or two effluent samples that slightly exceeded (sites #4, #5, and #7).

The criteria comparison in Table 10 is a worst-case assessment in several respects:

1. Metals concentrations in the effluents and plumes would be subjected to further dilution in the river.
2. Subsamples for the effluent composites were only taken when the suction hose was in contact with the streambed. A true time-weighted composite would have included subsamples when the intake was lifted off the bottom – as periodically occurs – and only river water was being pumped through the dredge, resulting in lower average concentrations in the discharge.
3. Less restrictive water quality criteria would apply at other times of the dredging season when hardness levels are higher. For example, the acute criteria for copper increase from 6.5 to 9.6 ug/L going from a hardness of 52 mg/L (June 2004) to 82 mg/L (August 2004).
4. Once the effluents are discharged, the metals will partition into dissolved and particulate fractions. The dissolved fraction is the primary toxicity concern.

As previously described, ambient arsenic concentrations in the Similkameen River substantially exceed the Washington State human health criteria of 0.018 and 0.14 ug/L, due to natural conditions which have been exacerbated by historic land-based mining activity. The relative impact of dredge effluents on the already elevated arsenic concentrations in the river is assessed below.

Effect of Multiple Dredges

The metals concentrations measured in gold dredge effluents during the present study were at or below aquatic life criteria. Therefore, criteria exceedances would not be anticipated in the Similkameen River, regardless of the number of dredges operating. A series of dilution calculations were done to estimate what effect multiple dredges would have on metals concentrations in the river. As a point of reference, the maximum number of dredges Ecology personnel have observed on the Similkameen is approximately 20.

The calculations were done for both the average September flow and the 7-day, 10-year low flow, 616 cfs and 182 cfs, respectively (USGS Nighthawk gage). The August ambient data (Table 5) were used for the upstream metals concentrations. At that time the river was at 581 cfs. The detection limit was used for zinc and lead.

Average metal concentrations were used for the dredge effluents (Table 6), adjusted for the fraction that would be expected to be in the dissolved phase (based on the dissolved/total recoverable ratios in Table 5). Effluent flow rates ranged from 0.4 - 1.2 cfs, averaging 0.7 cfs (Appendix C); 1.0 cfs was used in the calculations. It was assumed the dredges operated continuously.

The results of the dilution calculations are in Table 11. During average September flows, it is estimated that somewhere between 17 and 57 dredges operating continuously would be required to increase dissolved zinc, lead, and copper concentrations in the Similkameen River by 10%. It would take between approximately 200 and 520 dredges to have the same effect on total recoverable and dissolved arsenic, respectively. In order for zinc, lead, or copper concentrations to be doubled in the river, anywhere from 170 to 570 dredges would need to be operating. Arsenic concentrations in the dredge effluents are too low to cause an increase of that magnitude, regardless of river flow.

At the 7-day, 10-year low flow in the Similkameen, relatively few dredges could effect a 10% change in copper, lead, and zinc concentrations. It would take 50 or more continuously operating dredges to double concentrations of these metals.

As demonstrated elsewhere in this report, a 100% increase in the ambient arsenic, copper, lead, or zinc concentrations in the Similkameen River would not result in exceedances of aquatic life criteria.

Table 11. Estimated Number of Dredges Required to Increase Metals Concentrations in the Similkameen River by 1%, 10%, and 100% [see text for assumptions and data used]

	@ Average September Flow - 616 cfs		
	1%	10%	100%
Tot. Rec. Arsenic	20	200	**
Dissolved Arsenic	52	520	**
Dissolved Copper	6	57	570
Dissolved Lead	3	31	310
Dissolved Zinc	2	17	170

	@ 7-Day, 10-Year Low Flow - 182 cfs		
	1%	10%	100%
Tot. Rec. Arsenic	6	59	**
Dissolved Arsenic	15	150	**
Dissolved Copper	2	17	170
Dissolved Lead	1	9	92
Dissolved Zinc	1	5	51

****effluent concentration too low to result in 100% increase**

Results of this study show that the concentrations of arsenic, copper, lead, and zinc discharged from small-scale gold dredges operating in the Similkameen River are not a significant toxicity concern for aquatic life. Although this activity will exacerbate the exceedances of the arsenic human health criteria that already occur, it would take very large numbers of dredges to effect a 10% change in the river's arsenic levels, even at low-flow conditions.

These conclusions may not apply to the sediment deposits behind Enloe Dam. This material could have different physical/chemical properties than the sediments evaluated in the present study.

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Appendices

- A. Results from Analyzing Metals and Organic Compounds in Similkameen River Sediment Samples**
- B. Metals Data for Ecology Routine Monitoring Station 49B070, Similkameen River at Oroville**
- C. Site Locations and Other Information on the Similkameen River Gold Dredge Samples**
- D. Results on Laboratory Duplicates for the Similkameen River Gold Dredge Study**
- E. Results on Field Blanks for the Similkameen River Gold Dredge Study**

Appendix A-1. Results of Metals and Cyanide Analyses on Similkameen River Sediment Samples (mg/Kg, dry weight)

Site No.	Date	Sample No.	Depth Interval	Iron	Aluminum	Manganese	Zinc	Copper	Arsenic	Chromium	Nickel	Lead	Cadmium
1	29-Aug-95	358246	0-2 cm	12900	7030	UPPER RIVER	35	22	12	12	12	2.4	0.3 U
2	23-Aug-98	398060	0-10 cm	14000	6980	NA	32	25	11	13	11	3.3	0.5 U
3	24-Aug-98	398061	0-10 cm	15700	7790	PALMER LAKE - NIGHTHAWK	35	28	17	15	15	3.9	0.5 U
4	30-Aug-95	358244	0-2 cm	19500	10700	NA	56	60	30	21	19	5.4	0.3 U
4	24-Aug-98	398062	0-10 cm	19900	10100	NA	48	51	43	22	19	5.4	0.5 U
5	30-Aug-95	358243	0-2 cm	17000	8490	300	46	43	46	18	17	4.5	0.3 U
5	24-Aug-98	398063	0-10 cm	13400	7040	NA	29	17	9.5	11	9.1	2.4	0.5 U
6	24-Aug-98	398064	0-10 cm	14700	7230	EAGLE ROCK	33	24	19	13	12	3.0	0.5 U
7	23-Aug-98	398065	0-10 cm	14200	7080	ENLOE DAM	31	18	12	13	12	2.4	0.5 UJ
7	30-Sep-99	408020	0-1 ft	NA	NA	NA	36	21	15	15	11	3.2	1.1
7	30-Sep-99	408021	1-2 ft	NA	NA	NA	31	13	7	11	7.8	2.0	0.86
8	30-Sep-99	408022	0-1 ft	NA	NA	NA	32	13	7.8	12	8.6	2.2	0.81
8	30-Sep-99	408023	1-2 ft	NA	NA	NA	30	12	7.2	11	7.9	2.0	0.79
9	30-Aug-95	358242	0-2 cm	16200	8940	305	50	45	21	18	16	4.1	0.3 U
9	23-Aug-98	398066	0-10 cm	14600	7275	NA	32	21	14	14	12	2.8	0.5 U
9	30-Sep-99	408024	0-1 ft	NA	NA	NA	33	17	10	13	9.2	2.3	0.94

Note: Detections highlighted in **BOLD**

NA = not analyzed

U = not detected at or above reported value

J = estimated value

UJ = not detected at or above reported estimated value

Appendix A-1. (continued)

Site No.	Date	Sample No.	Depth Interval	Silver	Beryllium	Thallium	Mercury	Antimony	Selenium	Cyanide
1	29-Aug-95	358246	0-2 cm	UPPER RIVER						
2	23-Aug-98	398060	0-10 cm	0.3 U 0.66	NA 0.24	NA 0.38 J	0.01 U 0.012	NA 4 UJ	0.4 U 0.3 U	NA 0.10 U
3	24-Aug-98	398061	0-10 cm	PALMER LAKE - NIGHTHAWK						
4	30-Aug-95	358244	0-2 cm	0.78	0.28	0.50 J	0.018 J	4 UJ	0.3 U	0.10 U
4	24-Aug-98	398062	0-10 cm	0.30 J	NA	NA	0.012	NA	0.4 U	NA
5	30-Aug-95	358243	0-2 cm	0.83	0.38	0.3 U	0.029	4 UJ	0.3 U	0.10 U
5	24-Aug-98	398063	0-10 cm	0.30 J	NA	NA	0.01 U	NA	0.4 U	NA
				0.59	0.24	0.3 U	0.031	4 UJ	0.3 U	0.10 U
6	24-Aug-98	398064	0-10 cm	EAGLE ROCK						
				0.74	0.23	0.3 U	0.0085	4 UJ	0.3 U	0.10 U
7	23-Aug-98	398065	0-10 cm	ENLOE DAM RESERVOIR						
7	30-Sep-99	408020	0-1 ft	0.58	0.21	0.3 U	0.0072	4 UJ	0.3 U	0.10 U
7	30-Sep-99	408021	1-2 ft	2 U	1.3	0.3 U	0.013	5 UJ	0.3 U	NA
				2 U	0.97	0.3 U	0.01 U	5 UJ	0.3 U	NA
8	30-Sep-99	408022	0-1 ft	2 U	1.2	0.3 U	0.01 U	5 UJ	0.3 U	NA
8	30-Sep-99	408023	1-2 ft	2 U	1.0	0.3 U	0.01 U	5 UJ	0.3 U	NA
9	30-Aug-95	358242	0-2 cm	0.3 U	NA	NA	0.012	NA	0.4 U	NA
9	23-Aug-98	398066	0-10 cm	0.73	0.23	0.3 U	0.014 J	4 UJ	0.3 U	0.10 U
9	30-Sep-99	408024	0-1 ft	2 U	1.1	0.3 U	0.01 U	5 UJ	0.3 U	NA

Note: Detections highlighted in **BOLD**

NA = not analyzed

U = not detected at or above reported value

J = estimated value

UJ = not detected at or above reported estimated value

Appendix A-2. Results from Analyzing Semivolatiles, PCBs, and Pesticides in Core Samples Collected behind Enloe Dam in September 1999 (ug/Kg, dry weight; only detected compounds shown)

Site No. Location Depth Interval (cm) Sample No.	Station 7 Upper Reservoir 0-30 30-60 408020 408021		Station 8 Middle Reservoir 0-30 30-60 408022 408023		Station 9 Lower Res 0-30 408024
Semivolatiles					
<u>Polyaromatic Hydrocarbons</u>					
Naphthalene	13	6.7 U	7.8 J	12 U	7.9 J
1-Methylnaphthalene	14	6.7 U	5.8 J	5.6 J	7.6 J
2-Methylnaphthalene	17	6.7 U	9.2 J	8.2 J	10 J
Fluorene	8.9 J	6.7 U	12 U	12 U	12 U
Phenanthrene	55	4.2 J	8.9 J	8.0 J	12 J
Anthracene	23	6.7 U	12 U	12 U	12 U
Fluoranthene	13 U	4.2 J	8.7 J	12 U	9.7 J
Pyrene	8.4 J	6.7 U	6.6 J	6.3 J	7.7 J
Benzo(a)anthracene	13 U	5.2 J	12 U	9.4 NJ	12 U
Chrysene	13 U	6.7 U	12 U	12 U	9.6 J
Total PAH	139	14	47	38	64
<u>Miscellaneous Compounds</u>					
2-Methylphenol	8.5	6.7 U	12 U	12 U	5.9 J
4-Chloro-3-Methylphenol	13 U	6.7 U	12 U	12 U	17
2-Nitroaniline	13 U	6.7 U	12 U	12 U	36
3-Nitroaniline	49	6.7 U	12 U	12 U	12 U
Dibenzofuran	12 J	6.7 U	6.4 J	6.3 J	7.0 J
Retene	522	7.9	83	48	203
Carbazole	1.2 J	6.7 U	12 U	12 U	12 U
Di-N-butylphthalate	3490 E	54 U	386 U	711 U	243 U
Butylbenzylphthalate	26 U	10	19 U	23 U	22 U
PCBs	ND	ND	ND	ND	ND
Chlorinated Pesticides	ND	ND	ND	ND	ND
Organophosphorus Pesticides	ND	ND	ND	ND	ND
Nitrogen Pesticides	ND	ND	ND	ND	ND

Note: Detections highlighted in **BOLD** NJ = evidence analyte is present; value is an estimate
 U = not detected at or above reported value E = estimated value that exceeds the calibration
 J = estimated value ND = not detected

Appendix B. Metals Data for Ecology Routine Monitoring Station 49B070, Similkameen River @ Oroville (ug/L)

Date	Arsenic		Cadmium		Chromium		Copper	
	Diss.	Tot. Res.	Diss.	Tot. Res.	Diss.	Tot. Res.	Diss.	Tot. Res.
09-Oct-95			0.04 U	0.1 U		1 U	0.609	0.7
11-Dec-95		21.6	0.04 U	0.1 U		4	2.51	10.1
12-Feb-96		1.94	0.02 U	0.1 U		5 U	0.972	1.5 B
15-Apr-96		3.6	0.077 J	0.1 U		1.5	521 J	5.2
11-Jun-96		6.27	0.022	0.1 U		1.4	1.39	6.3
13-Aug-96		3.78	0.04	0.1 U		0.4 U	0.846	1.3
15-Oct-96		2.77	0.019	0.1 U		0.4 U	0.759	1.1 J
10-Dec-96		1.9	0.019	0.1 U		0.4 U	0.48	0.7
15-Apr-97		2.04	0.02 U	0.1 U		0.27	1.21	2.3
10-Jun-97		8.28	0.02 U	0.1 U		1.4	1.44	8.7
12-Aug-97		4.18	0.02 U	0.1 U		0.2 U	0.881	1.1
15-Dec-98			0.02 U				0.554	
11-May-99			0.02 U				1.22	
02-May-00		3.4						
06-Jun-00		4.6						
11-Jul-00		2.1						
15-Aug-00	5.4	4.4						
05-Sep-00		3.3						
04-Oct-00		2.6						
08-Nov-00								
06-Dec-00								
17-Jan-01								
07-Feb-01								
07-Mar-01								
04-Apr-01	2.36	2.25						
09-May-01	1.6	2.35						
06-Jun-01								
08-Oct-02	3.09	3.07	0.1 U	0.1 U	0.42	0.5 U	0.81	0.99
03-Dec-02	2.06	1.93	0.02 U	0.1 U	0.75	0.5 U	0.51	0.75
04-Feb-03	1.73	1.61	0.02 U	0.1 U	0.3	0.5 U	0.74	1.01
08-Apr-03	1.64	1.7	0.1 U	0.1 U	0.5 U	0.5 U	0.5 U	1.39 J
03-Jun-03	1.5	4.33	0.02 U	0.1 U	0.25 U	1.3	1.18	4.57
05-Aug-03	6.37	5.61	0.02 U	0.1 U	0.4	0.5 U	0.77	0.98

B = The analyte was detected in the method blank.

U = The analyte was not detected at or above the reported result.

J = The analyte was positively identified. The associated numerical result is an estimate.

Appendix B. (continued)

Date	Lead Diss.	Lead Tot. Rec.	Mercury Tot.	Nickel Diss.	Nickel Tot. Rec.	Zinc Diss.	Zinc Tot. Rec.	Hardness
09-Oct-95	0.03 U	0.1 U	0.001 U	1 U	1 U	1.1	5.9 B	86
11-Dec-95	0.362	1.5	0.001	1 U		5 U	14.1 B	82
12-Feb-96	0.025	0.1	0.001 U			1.2 B	5 U	76
15-Apr-96	0.72 J	0.8	0.002	0.586		4.2 B	4.8	63
11-Jun-96	0.032	0.8	0.004	1.62 J		1.1	10.8 B	43
13-Aug-96	0.02 U	1	0.001 U	0.508		1	3.4 B	78
15-Oct-96	0.087	0.1 U	0.002 U	0.615		1.4 J	3.5 J	98
10-Dec-96	0.03 U	0.2	0.001 U	0.6		0.76	4 J	95
15-Apr-97	0.02 U	0.2	0.002 U	0.5		0.49	14.6	95
10-Jun-97	0.03	0.9	0.002 U	0.73		3.37	13 J	45
12-Aug-97	0.039	0.2	0.002 U	0.562		1.81	2.2	87
15-Dec-98	0.02 U		0.002 U	0.602		0.77		112
11-May-99	0.027		0.002 U	0.898		1.4 J		66
02-May-00			0.003	0.665				
06-Jun-00								
11-Jul-00								
15-Aug-00								95.4
05-Sep-00								88.6
04-Oct-00								90.1
08-Nov-00								86.8
06-Dec-00								104
17-Jan-01								103
07-Feb-01								103
07-Mar-01								73.2
04-Apr-01								103
09-May-01								
06-Jun-01								
08-Oct-02	0.02 U	0.14	0.002 U	0.49	0.81	1 U	5 U	46.7
03-Dec-02	0.036	0.1 U	0.0033	0.73	0.71	1 U	5 U	94.6
04-Feb-03	0.02 U	0.1 U	0.002 U	0.39	0.46	1 U	5 U	97.8
08-Apr-03	0.02 U	0.11	0.004 U	0.62	0.91	1.1	5 U	81.4
03-Jun-03	0.041	0.44	0.0066	0.39	1.33	1.3	5.7	79.4
05-Aug-03	0.02 U	0.1 U	0.002 U	0.54	0.66	1 U	5 U	38.3
05-Aug-03								94.7
								38.3

B = The analyte was detected in the method blank.

U = The analyte was not detected at or above the reported result.

J = The analyte was positively identified. The associated numerical result is an estimate.

Appendix C. Site Locations and Other Information on Similkameen River Gold Dredge Samples

Site No. Date Owner	Site Description	River Mile		Dredge Description and Operation	Effluent Flow		
		Latitude	Longitude*		Stream	Depth/Velocity	Ecology Personnel
#1 1-Jul-04 Creegan	Approx. 500 ft. below BNR bridge, left bank	6.5		"Precision" dredge, 5" intake reduced to 4", 250 gpm pump, 6-8 feet off bank	1.2 cfs		Peterschmidt Johnson
		48 56 54 119 27 40			2.5 ft. / 2.3 fps	cobble w/ gravel & sand	
#2 1-Jul-04 Lease	Approx. 100 yards below Eagle Rock, left bank	10.8		Custom, 6" intake reduced to 4", 1,200-1,500 gpm pump, 6 feet off bank	1.2 cfs		Peterschmidt Johnson
		48 58 58 119 32 05			3 ft. / 0.9 fps	cobble w/ sand	
#3 18-Aug-04 Chung	S-turn @ irrigation canal crossing, left bank	13.7		Stilt mounted, 2.5" intake, 6.5 hp, working in streamside hole	no data		Coffin Latham
		48 59 15 119 32 25			1.5 ft. / 1.4 fps	cobble and boulders	
#4 18-Aug-04 Sweeney	Approx. 1/2 mile upstream of S-turn, left bank	14.1		Floating dredge, 3" intake, 5 hp pump, 3 feet off bank	no data		Coffin Latham
		48 59 20 119 34 36			1 ft. / 0.9 fps	boulders	
#5 18-Aug-04 Hard	Approx. 1 mile above Eagle Rock, left bank	11.1		Floating dredge, 4" intake, 5 hp pump	no data		Coffin Latham
		48 58 51 119 32 24			3 ft. / 2.2 fps	bedrock w/ fines	
#6 19-Aug-04 Franklin	Above Eagle Rock, left bank	10.9		"Keene" dredge, 4" intake, 5 hp pump	no data		Coffin Latham
		48 58 53 119 32 17			1.3 ft. / 2.5 fps	cobble and bedrock	
#7 18-Aug-04 Estes	Approx. 2 miles below Nighthawk left bank	15.8		"Keene" triple sluice, 4" intake, 300-450 gpm, 20 feet off bank	no data		Coffin Latham
		48 29 12 119 33 58			1.4 ft. / 0.35 fps	large cobble w/ fines	
#8 18-Aug-04 Wade	River Oaks RV Resort, left bank	5.2		"Dahlke Polydredge", 4" intake, 300 gpm, 5 hp pump, 20 feet off bank	1.0 cfs		Johnson Wittmeier
		48 56 13 119 26 35			1.5 ft / 0.5 fps	cobble	

Appendix C. (continued)

Site No. Date Owner	Site Description	River Mile		Dredge Description and Operation	Effluent Flow		
		Latitude	Longitude*		Stream Depth/Velocity†	Substrate	Ecology Personnel
#9 19-Aug-04 --	Approx. 1.5 miles above Eagle Rock, left bank	13 48 59 08 119 33 39		3" intake, 5.5 hp pump, 20 feet off bank	0.2 cfs 1.3 ft. / 0.7 fps cobble and gravel		Peterschmidt Johnson
#10 18-Aug-04 Wade	River Oaks RV Resort, left bank	5.2 48 56 13 119 26 35		"Dahlke Polydredge", 4" intake, 300 gpm, 5 hp pump, 20 feet off bank	1.0 cfs 1.5 ft / 0.5 fps cobble		Johnson Wittmeier
#11 19-Aug-04 --	Approx. 1/2 mile above S-turn, left bank	14.3 48 59 20 119 34 50		Custom dredge, 4" intake, 5.5 hp pump, 30 feet off bank	0.4 cfs 2 ft. / 0.3 fps cobble		Peterschmidt Johnson
#12 21-Sep-04 Chase	"Boat ramp", left bank	13.3 48 58 50 119 32 32		Floating dredge, 4" intake, 7 hp pump, 10 feet off bank	0.5 cfs 1.5 ft. / 0.85 fps cobble and gravel		Peterschmidt Johnson
#13 21-Sep-04 Miltner	Approx. 1 mile above Eagle Rock, left bank	12.8 48 58 54 119 33 24		Floating dredge, 4" intake, 5.5 hp pump, 10 feet off bank	0.4 cfs 0.9 ft. / 1.3 fps cobble w/ gravel & silt		Peterschmidt Johnson
#14 22-Sep-04 --	Approx. 1 mile below Enloe Dam, left bank	8.5 48 57 41 119 29 46		Floating dredge, 2.4 inch intake, 6.5 hp pump, 15 feet off bank	-- -- boulders		Peterschmidt

*NAD 27

†immediately upstream of dredge intake hose

Three replicate samples were collected on each of the above dates and analyzed for total recoverable³ and dissolved arsenic, copper, lead, and zinc, turbidity, and hardness. In addition to establishing background conditions, the results provided information on particulate vs. dissolved metals which was needed to evaluate the effluent data.

Effluent Samples

Dredging primarily occurs from a few miles below Nighthawk (r.m. 17.5) down to Oroville near the mouth of the river. Dredges operating at the 14 sites shown in Figure 5 were opportunistically sampled. An attempt was made to distribute the sampling effort equally up and down the river. No samples were obtained in the reservoir behind Enloe Dam as dredges normally do not operate there.

A single sample was collected from each dredge at the point the discharge left the sluice box. For dredge operations where the turbidity plume was being sampled, three effluent samples were collected.

In an effort to obtain a representative time-dependent composite, the effluent samples were collected by filling a one-liter sample bottle in small increments over a five-to-ten minute period. The samples were allowed to settle for approximately one hour and then ½ liter decanted into sample containers. This procedure removed sand and other large particles that would normally settle out of the water column. A settling time of one hour was selected based on the settleable solids analysis in EPA Method 160.5.

The effluents were analyzed for total recoverable arsenic, copper, lead, and zinc.

For selected dredges, the effluent flow rate was estimated from discharge velocity measurements and the dimensions of the sluice box. River velocity and substrate characteristics were also recorded.

Detailed information on the location of the effluent sampling sites, dredge descriptions, flows, and substrate characteristics can be found in Appendix C.

Plume Samples

The plumes from three dredges operating under different flow regimes – one each in July, August, and September – were sampled to gage the downstream extent of the impacted area (Figure 5). Three samples each were collected at 10, 50, and 200 feet below the dredge, staggered over approximately a 30-minute period. A marked polyethylene line with a float at the far end was attached to the back of the dredge to locate downstream sampling points. The distance of the furthest downstream sample was based on the *Gold and Fish* pamphlet requirement that dredges be separated by 200 feet.

³ Total recoverable metals refers to a laboratory procedure where a sample is subjected to strong acid digestion prior to analysis. A total metals analysis employs a more thorough digestion of the sample. A total recoverable analysis is typically done for surface water samples and, for present purposes, is essentially equivalent to total metals.

Three separate effluent samples were collected at the same time the plume was being sampled. A single sample was also collected immediately upstream of the dredge suction hose for comparison with the plume. The effluent was analyzed for total recoverable metals.

The upstream and plume samples were analyzed for total recoverable arsenic, dissolved copper, lead, and zinc, TSS, turbidity, and hardness. Arsenic was analyzed as total recoverable for comparison to the human health standards, which are based on inorganic arsenic. Most of the arsenic in the Similkameen River water is in inorganic form (Johnson, 2002a). Measuring inorganic arsenic directly would have significantly increased the cost of the study. Total recoverable arsenic can reasonably be compared to the dissolved aquatic life criteria, since they differ only slightly from the older total recoverable criteria on which they are based. Copper, lead, and zinc were analyzed as dissolved for direct comparison with the aquatic life standards.

Number of Samples

The number and type of samples collected for this project are summarized in Table 2.

Table 2. Number and Type of Samples Collected for the 2004 Similkameen River Gold Dredge Study

Sample Type	No. of Sites	Samples per Site	Sub-total	Analyses
Ambient River	1	9	9	TR As, Cu, Pb, Zn; Diss Cu, Pb, Zn; TSS; turbidity; hardness
Above Dredge	14	1	14	TR As; Diss Cu, Pb, Zn; TSS; turbidity; hardness
Dredge Effluent	14	1-3	20	TR As, Cu, Pb, Zn
Dredge Plume	3	9	27	TR As; Diss Cu, Pb, Zn; TSS; turbidity; hardness
Bottle Blanks	1	3	3	TR As, Cu, Pb, Zn
Filter Blanks	1	3	3	Diss As, Cu, Pb, Zn
Total =			76	

TR = total recoverable

Diss = dissolved

Field Procedures

Table 3 lists the sample size, container, preservation, and recommended holding time for each study parameter. Sample containers were obtained from Manchester Laboratory. Metals sampling procedures followed the guidance in EPA (1995) *Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*. All samples were taken as simple grabs or grab composites.

Table 3. Sample Containers, Preservation, and Holding Times for Water Samples

Parameter	Minimum Quality Required	Container	Preservative*	Holding Time
Metals	250 mL	500 mL Teflon bottle	HNO ₃ to pH<2, 4°C	6 months
Hardness	100 mL	125 mL poly bottle	H ₂ SO ₄ to pH<2, 4°C	6 months
TSS	1,000 mL	1,000 mL poly bottle	Cool to 4°C	7 days
Turbidity	100 mL	500 mL poly bottle	Cool to 4°C	48 hours

*dissolved metals samples filtered in the field (0.45 micron)

Metals samples were collected directly into pre-cleaned 500 mL (plume and ambient samples) or 1 L (effluent samples) Teflon bottles. The effluent samples were allowed to settle and were then decanted, as previously described. Samples for dissolved metals were filtered in the field through a pre-cleaned 0.45 µm Nalgene filter unit (#450-0045, type S). The filtrate was transferred to a new pre-cleaned 500 mL Teflon bottle. The whole water and filtered water samples were preserved to pH <2 with sub-boiled 1:1 nitric acid, carried in small Teflon vials. Teflon sample bottles, Nalgene filters, and Teflon acid vials were cleaned by Manchester, as described in Kammin et al. (1995), and sealed in plastic bags. Non-talc nitrile gloves were worn by personnel filtering the samples. Filtering was done in a glove box constructed of a PVC frame and polyethylene cover.

Flow was measured with a Marsh-McBirney meter and top-setting rod. A hand-held GPS was used to record sampling locations. All samples were placed in polyethylene bags, held on ice for transport to Ecology HQ, and then taken by courier to Manchester Laboratory within one to two days of collection. Chain-of-custody procedures were followed (Manchester Environmental Laboratory, 2003).

Laboratory Procedures

Table 4 shows the analytical methods used in this project.

Table 4. Laboratory Procedures

Analyte	Sample Matrix	Sample Prep Method	Analytical Method
Arsenic, Copper, Lead, Zinc	whole water	HNO ₃ /HCl digest	EPA 200.8
Copper, Lead, Zinc	filtered water	analyze directly	EPA 200.8
Hardness	whole water	N/A	EPA 200.7
TSS	whole water	N/A	EPA 160.2
Turbidity	whole water	N/A	EPA 180.1

N/A = not applicable

Manchester Laboratory prepared written quality assurance reviews on the quality of the chemical data for this project. The reviews include an assessment of sample condition on receipt at the laboratory, compliance with holding times, instrument calibration, procedural blanks, laboratory control samples, matrix spike and matrix spike duplicate recoveries, and duplicate sample analyses. No significant problems were encountered that compromise the accuracy, validity, or usefulness of the data. The quality assurance reviews and complete chemical data for this project are available from the author.

The precision of the data reported here can be assessed from results of duplicate analyses conducted on selected samples (Appendix D). Dissolved metal determinations agreed within 10%. Total recoverable metals agreed within approximately 20%, except 36% for zinc in one sample. Results for TSS, turbidity, and hardness were also in close agreement.

Field blanks were analyzed to detect metals contamination arising from sample containers or the filtration procedure. Bottle blanks were prepared at Manchester Laboratory by filling the Teflon sample bottles with deionized water. Filter blanks were prepared by filtering half the contents of a bottle blank. The field blanks were treated the same as samples.

Bottle and filter blanks were analyzed on three occasions during the project (Appendix E). There was a trace amount of zinc in the filter blanks (0.56 – 1.1 ug/L). The other metals were not detected in either type of blank. This demonstrates that the sample collection, preservation, and filtration procedures were not contributing significant amounts of metals to the samples.

River Flow

Figure 6 compares historical average flow in the Similkameen River with the flows encountered when samples were collected for the 2004 gold dredge study. The data are from USGS monitoring station #12442500 at Nighthawk.

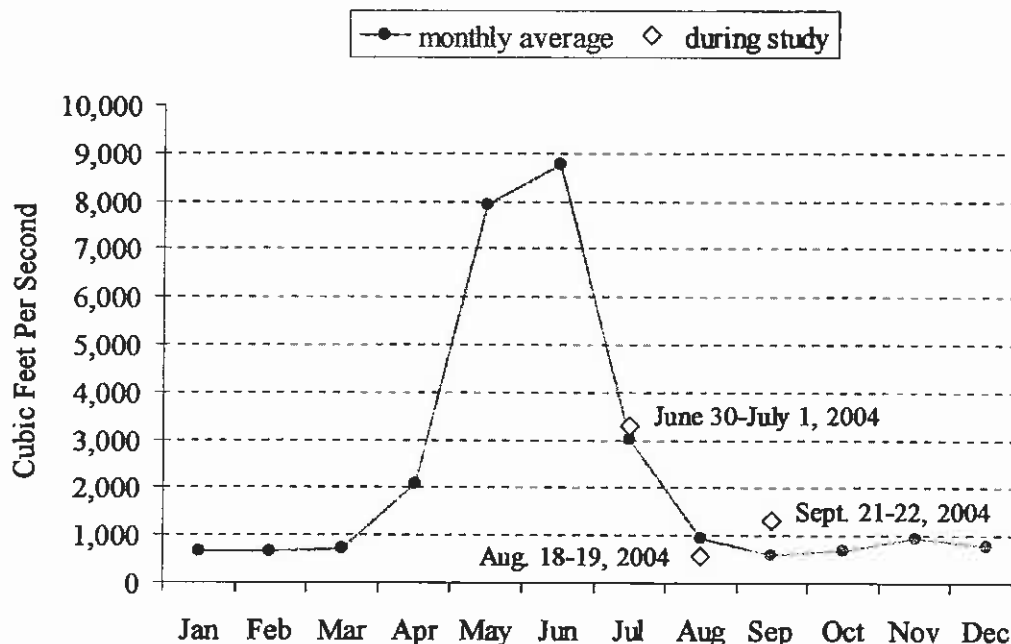


Figure 6. Monthly Average Flow in the Similkameen River, Showing Flows When Gold Dredge Samples were Collected (USGS station 12442500, 1928 – 2002).

As shown in Figure 6 and summarized below, river flows during gold dredge sampling were representative of the range of summer flows normally encountered in the Similkameen. Dry August weather resulted in low-flow conditions that were not anticipated to occur until the following month. Wet weather caused higher than normal discharge during the September sample collection.

Month	Average Flow	
	Historical	During Sampling
July	3,029 cfs	3,300 cfs
August	936 cfs	581 cfs
September	616 cfs	1,320 cfs

Ambient Water Quality

Ambient levels of TSS, turbidity, metals, and hardness measured in the Similkameen during the 2004 dredging season are summarized in Table 5. As previously described, these samples were collected in the upper part of the reach where dredging is done, but when no dredges were operating. Each data point represents results from three replicate samples. Variability within each sample set was minimal.

Table 5. Ambient Water Quality Conditions in the Similkameen River During the 2004 Gold Dredging Season [mean \pm standard deviation of three replicates collected at river mile 14.0; no dredges operating]

Parameter	June 30	August 18	September 21	Overall Mean*
TSS (mg/L)	10 \pm 0	3 \pm 0.5	5 \pm 0	6
Turbidity (NTU)	4.2 \pm 0.4	2.2 \pm 0.1	2.4 \pm 0.05	2.9
Tot. Rec. Arsenic (ug/L)	3.9 \pm 0.1	4.2 \pm 0	2.2 \pm 0.1	3.4
Dissolved Arsenic (ug/L)	2.7 \pm 0.1	4.2 \pm 0	1.8 \pm 0	2.9
Tot. Rec. Copper (ug/L)	2.3 \pm 0.2	1.2 \pm 0	1.4 \pm 0	1.6
Dissolved Copper (ug/L)	0.82 \pm 0.05	0.84 \pm 0.01	0.97 \pm 0.1	0.88
Tot. Rec. Zinc (ug/L)	1.7 \pm 0.1	<1.0	1.2 \pm 0.1	1.3
Dissolved Zinc (ug/L)	0.92 \pm 0.1	1.1 \pm 0.1	2.2 \pm 1.5	1.4
Tot. Rec. Lead (ug/L)	0.14 \pm 0.02	<0.10	0.18 \pm 0.01	0.14
Dissolved Lead (ug/L)	<0.02	<0.10	0.09 \pm 0.05	0.07
Hardness (mg/L)	52 \pm 0.4	82 \pm 0.1	61 \pm 0.02	65

*detection limit used for non-detects

TSS, turbidity, and total recoverable zinc, copper, and lead varied directly with flow. The levels were highest in July (September for lead) and lowest in August. The highest total recoverable arsenic concentrations were in August. Hardness varied inversely with flow, reflecting the relatively greater contribution of groundwater when river discharge is low.

TSS and turbidity ranged from 3 - 10 mg/L and 2.2 - 4.2 NTU, respectively. Concentrations of total recoverable metals ranged from 2.4 - 4.2 ug/L for arsenic, 1.2 - 2.3 ug/L for copper, <1.0 - 1.7 ug/L for zinc, and <0.10 - 0.18 ug/L for lead. Total recoverable zinc and lead were below detection limits during the low flows of August.

Dissolved metals concentrations were 1.8 - 4.2 ug/L for arsenic, 0.82 - 0.97 ug/L for copper, 0.92 - 2.2 ug/L for zinc, and <0.02 - 0.09 ug/L for lead. Because of a zinc background in the filtration procedure, the dissolved results slightly exceeded total recoverable in most of the August and September samples. Trace zinc contamination is frequently encountered when analyzing at the low ppb level.

These results are consistent with historical data on the Similkameen River (Appendix B; Johnson 1997, 2002a). At the time of the gold dredge study, ambient levels of dissolved arsenic, copper, lead, and zinc were one to two orders of magnitude lower than the aquatic life criteria (see Table 1). Total recoverable arsenic exceeded the more restrictive human health criteria by one to two orders of magnitude. As discussed earlier in this report, arsenic concentrations in most rivers and streams naturally exceed the EPA human health criteria, although to a lesser extent than in the Similkameen. There are no human health criteria for copper, lead, or zinc.

Dredge Effluents

Metals concentrations measured in effluents from gold dredges operating in the lower Similkameen River are shown in Table 6. These data are for total recoverable metals.

Table 6. Metals Concentrations in Effluent Samples from Gold Dredges Operating in the Similkameen River During 2004 [ug/L, total recoverable]

Site No.	Date	Arsenic	Copper	Zinc	Lead
#1	July 1	3.8	2.3	1.9	0.23
#2	July 1	6.2	6.1	5.2	0.69
#3	August 18	6.4	4.7	9.1	0.67
#4	August 18	6.6	9.3	9.4	0.97
#5	August 18	6.6	8.3	7.3	1.1
#6	August 18	6.3	5.1	4.2	1.3
#7	August 18	4.6	2.4	1.8	0.16
#8	August 18	7.4	4.4	3.3	0.47
#9	August 19	5.6	3.3	3.0	0.39
#10	August 19	7.3	3.7	4.4	0.46
#11	August 19	8.0	5.4	7.4	0.75
#12	September 21	2.6	2.9	2.0	0.47
#13	September 21	3.3	4.7	3.6	0.62
#14	September 22	2.6	2.0	1.8	0.26
mean =		5.5	4.6	4.6	0.61
minimum =		2.6	2.0	1.8	0.16
maximum =		8.0	9.3	9.4	1.3

Although collected at 14 different locations and at varying stages in the dredging process, metals concentrations in the effluents did not differ greatly between sites. Minimum and maximum concentrations were within a factor of 2 for arsenic, factors of 4 - 5 for copper and zinc, and a factor of 8 for lead. Average concentrations were 5.5 ug/L arsenic, 4.6 ug/L copper, 4.6 ug/L zinc, and 0.61 ug/L lead. As described earlier, these samples were decanted, so did not include sand and other particles that would rapidly settle out of the water column following discharge.

Most of the effluent data are based on single samples composited over a five-to-ten minute period. Three separate composites were analyzed in conjunction with turbidity plume sampling at sites #1, #10, and #12. These samples were collected over a period of approximately 30 minutes (i.e., three five-to-ten minute composites per site) and also showed a low level of variability (Table 7). The average of the three composites is shown in Table 6.

Table 7. Variability of Replicate Gold Dredge Effluent Samples [ug/L, total recoverable]

Site No	Date	Time	Arsenic	Copper	Zinc	Lead
#1	July 1, 2004	115-1125	5.0	2.5	1.9	0.26
"	"	1335-1345	3.2	2.3	2.1	0.21
"	"	1155-1205	<u>3.3</u>	<u>2.2</u>	<u>1.6</u>	<u>0.23</u>
		mean \pm s.d.=	3.8 \pm 0.8	2.3 \pm 0.1	1.9 \pm 0.2	0.23 \pm 0.02
#10	Aug 18, 2004	1513-1518	7.1	3.2	3.8	0.41
"	"	1523-1528	7.8	4.9	5.5	0.58
"	"	1538-1543	<u>7.0</u>	<u>3.0</u>	<u>3.2</u>	<u>0.38</u>
		mean \pm s.d.=	7.3 \pm 0.4	3.7 \pm 0.9	4.4 \pm 0.8	0.46 \pm 0.1
#12	Sept 21, 2004	1330-1335	2.6	2.9	2.1	0.56
"	"	1338-1343	2.7	3.2	2.0	0.48
"	"	1345-1350	<u>2.5</u>	<u>2.6</u>	<u>1.9</u>	<u>0.38</u>
		mean \pm s.d.=	2.6 \pm 0.1	2.9 \pm 0.2	2.0 \pm 0.1	0.47 \pm 0.1

A perspective on the potential these effluents have to affect metals concentrations in the river can be gained from a comparison with the ambient data (Figure 7). Zinc and lead appear to be the metals of greatest potential concern, with effluent concentrations being up to approximately 10 times higher than ambient levels. Arsenic, on the other hand, exceeded background by a factor of 2 or less, suggesting a minimal impact. These data indicate that the potential for these metals to be increased due to dredging in the Similkameen River is, in decreasing order, zinc, lead, copper, and arsenic.

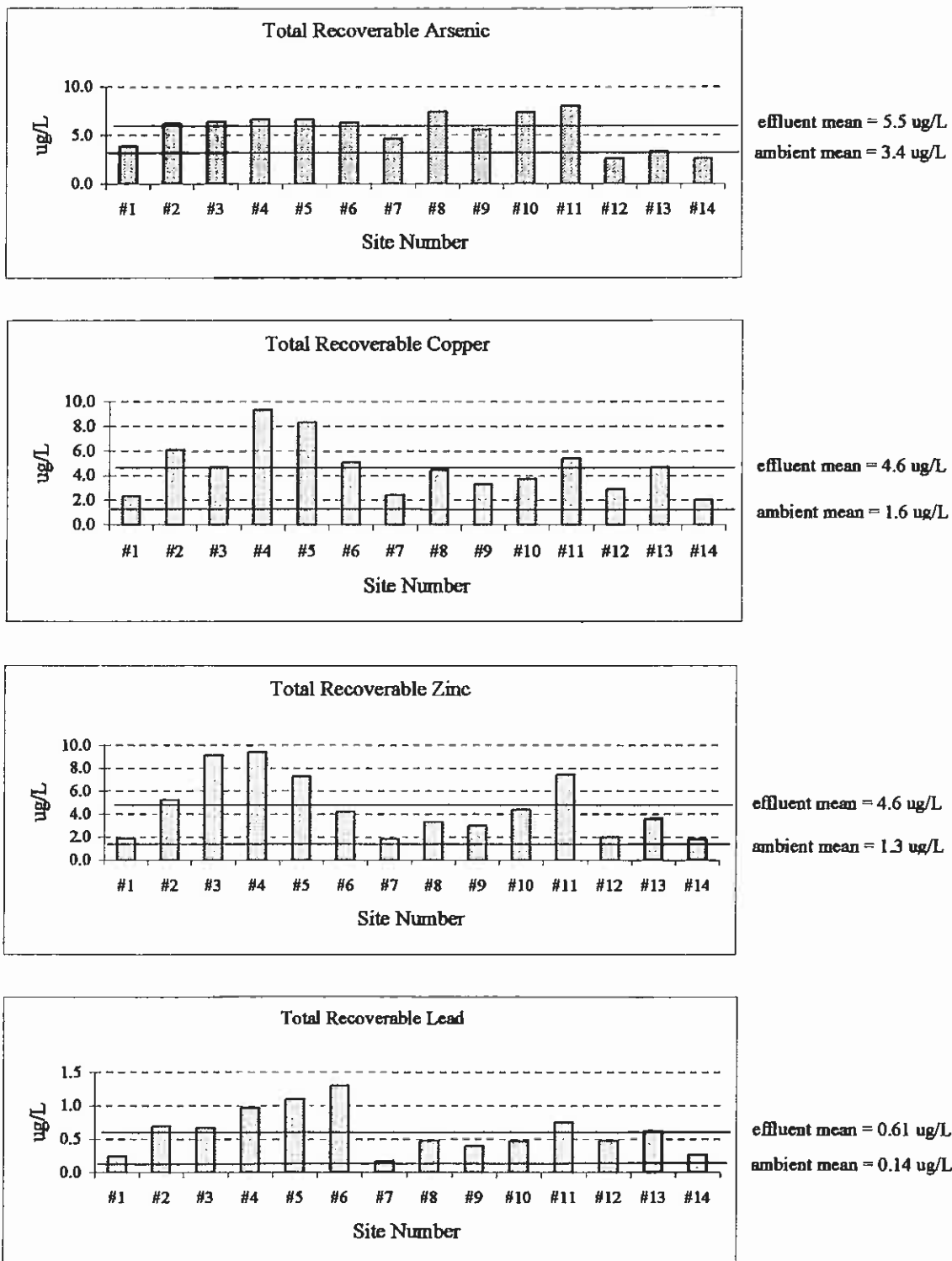


Figure 7. Metals Concentrations in Similkameen River Gold Dredge Effluents

Dredge Plumes

Turbidity plumes were sampled behind three gold dredges, one each at sites #1, #10, and #12. The results are summarized in Table 8. Each data point represents results from three replicate samples taken over approximately a 30-minute period. The effluent data are for total recoverable metals, while the plume and upstream data are for dissolved metals, except for total recoverable arsenic. (See Study Design for an explanation of analyzing total recoverable vs. dissolved metals.)

Table 8. Results from Sampling Gold Dredge Effluent Plumes in the Similkameen River During 2004 [mean \pm standard deviation of three samples, except a single sample collected above each dredge]

Parameter	Turbidity (NTU)	TSS (mg/L)	Diss. Zinc (ug/L)	Diss. Copper (ug/L)	Diss. Lead (ug/L)	T.R. Arsenic (ug/L)	Hardness (mg/L)
Site #1, July 1							
Above dredge	4.3	10	<0.50	1.0	<0.02	3.7	52
Dredge effluent*	N/A	N/A	1.9 \pm 0.2	2.3 \pm 0.1	0.23 \pm 0.02	3.8 \pm 0.8	N/A
10 ft. downstream	10 \pm 3.0	86 \pm 45	1.1 \pm 0.2	0.83 \pm 0.02	<0.02**	9.8 \pm 5.1	54 \pm 1
50 ft. downstream	7.6 \pm 3.0	68 \pm 23	1.1 \pm 0.2	0.83 \pm 0.02	<0.02 [†]	9.4 \pm 5.4	54 \pm 2
200 ft. downstream	5.2 \pm 1.0	20 \pm 3	0.6 \pm 0.1	0.87 \pm 0.09	<0.02	5.0 \pm 0.7	53 \pm 0.1
Site #10, August 18							
Above dredge	0.8	1	0.68	0.76	<0.10	5.3	88
Dredge effluent*	N/A	N/A	4.4 \pm 0.8	3.7 \pm 0.8	0.46 \pm 0.09	7.3 \pm 0.4	N/A
10 ft. downstream	12 \pm 0.5	32 \pm 7	2.0 \pm 0.7	0.86 \pm 0.01	<0.10	9.8 \pm 1.9	90 \pm 0.3
50 ft. downstream	3.6 \pm 1.0	7 \pm 2	1.3 \pm 0.1	0.81 \pm 0.01	<0.10	6.0 \pm 0.1	89 \pm 0.4
200 ft. downstream	1.4 \pm 0.2	3 \pm 0.5	1.1 \pm 0.2	0.81 \pm 0.01	<0.10	5.4 \pm 0	88 \pm 0.3
Site #12, September 21							
Above dredge	3.0	7	<0.50	0.94	0.032	2.2	59
Dredge effluent*	N/A	N/A	2.0 \pm 0.08	2.9 \pm 0.2	0.47 \pm 0.07	2.6 \pm 0.1	N/A
10 ft. downstream	11 \pm 0.5	44 \pm 9	0.88 \pm 0.1	0.99 \pm 0.01	0.039 \pm 0.001	4.0 \pm 0.4	60 \pm 0
50 ft. downstream	6.9 \pm 0.1	23 \pm 3	2.8 \pm 0.9	1.1 \pm 0.1	0.040 \pm 0.003	2.8 \pm 0.1	59 \pm 0
200 ft. downstream	4.0 \pm 0.9	8 \pm 2	0.93 \pm 0.3	0.94 \pm 0.01	0.035 \pm 0.002	2.4 \pm 0.1	59 \pm 0

N/A = not analyzed

*dredge effluent data are total recoverable metals

**one detection at 0.028 ug/L

[†]one detection at 0.027 ug/L

River flows at the time of sample collection were 3,300 cfs (site #1), 581 cfs (site #10), and 1,320 cfs (site #12). Current velocities at the dredge sites ranged from 1.5 to 2.5 feet per second, and water depths were between 1.5 and 4 feet. The substrates were cobble with varying amounts of sand and gravel.

Downstream changes in the plume can be better visualized in Figure 8 which plots average TSS, turbidity, and metals concentrations. Zinc was below detection limits in the August and September upstream samples, and lead was below detection limits in most of the July and August samples. The detection limit was plotted where these metals were not detected.

Table 9 compares the upstream TSS, turbidity, and metals concentrations with the average concentrations measured in the furthest downstream samples 200 feet below the dredge. The differences between the three sites illustrate the variability inherent in a dredge plume mixing under different conditions of river flow and turbulence.

Table 9. Percent Increases in TSS, Turbidity, and Metals Concentrations Measured 200 Feet Below Three Gold Dredges in the Similkameen River

Site No.	TSS (mg/L)	Turbidity (NTU)	Tot. Rec Arsenic (ug/L)	Dissolved Copper (ug/L)	Dissolved Zinc (ug/L)	Dissolved Lead (ug/L)
#1	100	21	35	0	20	ND
#10	200	75	2	7	62	ND
#12	<u>14</u>	<u>33</u>	<u>9</u>	<u>0</u>	<u>86</u>	<u>9</u>
mean =	100	43	15	2	56	9

ND = not detected

At 200 feet, complete mixing with the river had not occurred. On average, TSS concentrations 200 feet downstream of the dredges were twice as high (100% increase) as upstream of the dredges. Turbidity and dissolved zinc levels at 200 feet were half again as high as upstream (43 – 56% average increase). There was only a modest increase in arsenic, copper, and lead (2 – 15%).

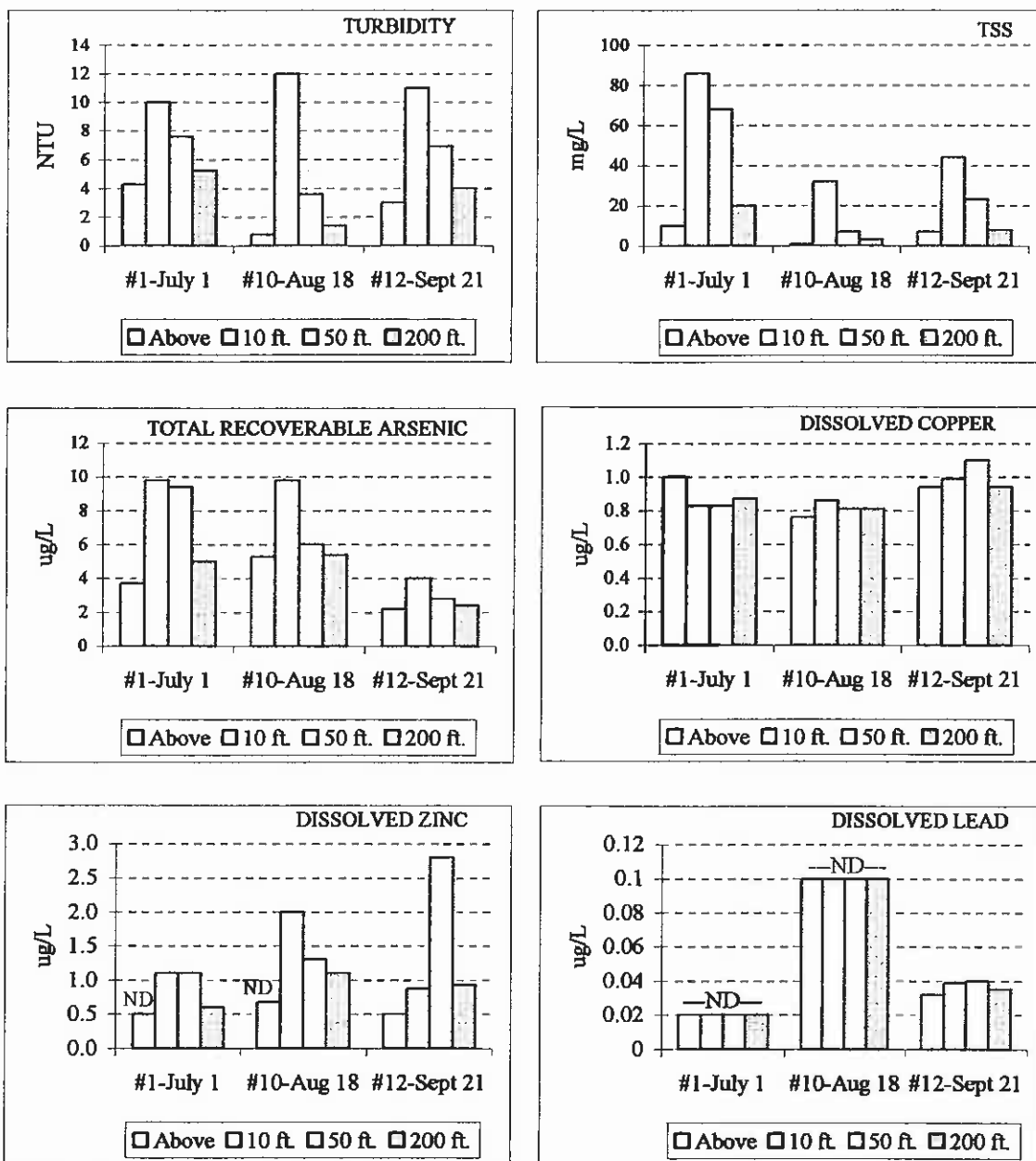


Figure 8. TSS, Turbidity, and Metals Concentrations Below Three Gold Dredges in the Similkameen River (mean of three grabs; ND = not detected).

Comparison with Water Quality Criteria

Table 10 compares the metals concentrations measured in Similkameen gold dredge effluents and dredge plumes with Washington state criteria for the protection of aquatic life. Copper, lead, and zinc toxicity varies inversely with hardness. The criteria were calculated for a hardness of 52 mg/L, the lowest recorded in the study.

Table 10. Metals Concentrations in Similkameen River Dredge Effluent and Plume Samples Compared to Criteria for Protection of Aquatic Life (ug/L)

	Arsenic	Copper	Lead	Zinc
Concentration Range in Effluents* (n=18)	2.6 - 8.0	2.0 - 9.3	0.16 - 1.3	1.8 - 9.4
Concentration Range Measured in Plume† (n=27)	2.3 - 17	0.79 - 1.2	<0.02 - 0.043	<0.5 - 4.1
Acute water quality criterion**	360	9.2	31	66
Chronic water quality criterion**	190	6.5	1.2	60

*total recoverable metals

†dissolved metals except total recoverable arsenic

**dissolved metals at 52 mg/L hardness (lowest recorded in study)

Based on analyzing 14 effluents and 27 plume samples, it appears that small-scale gold dredges have little or no potential to cause exceedances of aquatic life criteria in the Similkameen River. Arsenic and zinc concentration in dredge related samples were one to two orders of magnitude lower than criteria. Copper and lead concentrations were at or below criteria, except for one or two effluent samples that slightly exceeded (sites #4, #5, and #7).

The criteria comparison in Table 10 is a worst-case assessment in several respects:

1. Metals concentrations in the effluents and plumes would be subjected to further dilution in the river.
2. Subsamples for the effluent composites were only taken when the suction hose was in contact with the streambed. A true time-weighted composite would have included subsamples when the intake was lifted off the bottom – as periodically occurs – and only river water was being pumped through the dredge, resulting in lower average concentrations in the discharge.
3. Less restrictive water quality criteria would apply at other times of the dredging season when hardness levels are higher. For example, the acute criteria for copper increase from 6.5 to 9.6 ug/L going from a hardness of 52 mg/L (June 2004) to 82 mg/L (August 2004).
4. Once the effluents are discharged, the metals will partition into dissolved and particulate fractions. The dissolved fraction is the primary toxicity concern.

As previously described, ambient arsenic concentrations in the Similkameen River substantially exceed the Washington State human health criteria of 0.018 and 0.14 ug/L, due to natural conditions which have been exacerbated by historic land-based mining activity. The relative impact of dredge effluents on the already elevated arsenic concentrations in the river is assessed below.

Effect of Multiple Dredges

The metals concentrations measured in gold dredge effluents during the present study were at or below aquatic life criteria. Therefore, criteria exceedances would not be anticipated in the Similkameen River, regardless of the number of dredges operating. A series of dilution calculations were done to estimate what effect multiple dredges would have on metals concentrations in the river. As a point of reference, the maximum number of dredges Ecology personnel have observed on the Similkameen is approximately 20.

The calculations were done for both the average September flow and the 7-day, 10-year low flow, 616 cfs and 182 cfs, respectively (USGS Nighthawk gage). The August ambient data (Table 5) were used for the upstream metals concentrations. At that time the river was at 581 cfs. The detection limit was used for zinc and lead.

Average metal concentrations were used for the dredge effluents (Table 6), adjusted for the fraction that would be expected to be in the dissolved phase (based on the dissolved/total recoverable ratios in Table 5). Effluent flow rates ranged from 0.4 - 1.2 cfs, averaging 0.7 cfs (Appendix C); 1.0 cfs was used in the calculations. It was assumed the dredges operated continuously.

The results of the dilution calculations are in Table 11. During average September flows, it is estimated that somewhere between 17 and 57 dredges operating continuously would be required to increase dissolved zinc, lead, and copper concentrations in the Similkameen River by 10%. It would take between approximately 200 and 520 dredges to have the same effect on total recoverable and dissolved arsenic, respectively. In order for zinc, lead, or copper concentrations to be doubled in the river, anywhere from 170 to 570 dredges would need to be operating. Arsenic concentrations in the dredge effluents are too low to cause an increase of that magnitude, regardless of river flow.

At the 7-day, 10-year low flow in the Similkameen, relatively few dredges could effect a 10% change in copper, lead, and zinc concentrations. It would take 50 or more continuously operating dredges to double concentrations of these metals.

As demonstrated elsewhere in this report, a 100% increase in the ambient arsenic, copper, lead, or zinc concentrations in the Similkameen River would not result in exceedances of aquatic life criteria.

Table 11. Estimated Number of Dredges Required to Increase Metals Concentrations in the Similkameen River by 1%, 10%, and 100% [see text for assumptions and data used]

	@ Average September Flow - 616 cfs		
	1%	10%	100%
Tot. Rec. Arsenic	20	200	**
Dissolved Arsenic	52	520	**
Dissolved Copper	6	57	570
Dissolved Lead	3	31	310
Dissolved Zinc	2	17	170

	@ 7-Day, 10-Year Low Flow - 182 cfs		
	1%	10%	100%
Tot. Rec. Arsenic	6	59	**
Dissolved Arsenic	15	150	**
Dissolved Copper	2	17	170
Dissolved Lead	1	9	92
Dissolved Zinc	1	5	51

**effluent concentration too low to result in 100% increase

Results of this study show that the concentrations of arsenic, copper, lead, and zinc discharged from small-scale gold dredges operating in the Similkameen River are not a significant toxicity concern for aquatic life. Although this activity will exacerbate the exceedances of the arsenic human health criteria that already occur, it would take very large numbers of dredges to effect a 10% change in the river's arsenic levels, even at low-flow conditions.

These conclusions may not apply to the sediment deposits behind Enloe Dam. This material could have different physical/chemical properties than the sediments evaluated in the present study.

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Appendices

- A. Results from Analyzing Metals and Organic Compounds in Similkameen River Sediment Samples**
- B. Metals Data for Ecology Routine Monitoring Station 49B070, Similkameen River at Oroville**
- C. Site Locations and Other Information on the Similkameen River Gold Dredge Samples**
- D. Results on Laboratory Duplicates for the Similkameen River Gold Dredge Study**
- E. Results on Field Blanks for the Similkameen River Gold Dredge Study**

Appendix A-1. Results of Metals and Cyanide Analyses on Similkameen River Sediment Samples (mg/Kg, dry weight)

Site No.	Date	Sample No.	Depth Interval	Iron	Aluminum	Manganese	Zinc	Copper	Arsenic	Chromium	Nickel	Lead	Cadmium
1	29-Aug-95	358246	0-2 cm	12900	7030	UPPER RIVER	35	22	12	12	12	2.4	0.3 U
2	23-Aug-98	398060	0-10 cm	14000	6980	NA	32	25	11	13	11	3.3	0.5 U
3	24-Aug-98	398061	0-10 cm	15700	7790	PALMER LAKE - NIGHTHAWK	35	28	17	15	15	3.9	0.5 U
4	30-Aug-95	358244	0-2 cm	19500	10700	NA	56	60	30	21	19	5.4	0.3 U
4	24-Aug-98	398062	0-10 cm	19900	10100	NA	48	51	43	22	19	5.4	0.5 U
5	30-Aug-95	358243	0-2 cm	17000	8490	300	46	43	46	18	17	4.5	0.3 U
5	24-Aug-98	398063	0-10 cm	13400	7040	NA	29	17	9.5	11	9.1	2.4	0.5 U
6	24-Aug-98	398064	0-10 cm	14700	7230	EAGLE ROCK	33	24	19	13	12	3.0	0.5 U
7	23-Aug-98	398065	0-10 cm	14200	7080	ENLOE DAM	31	18	12	13	12	2.4	0.5 UJ
7	30-Sep-99	408020	0-1 ft	NA	NA	NA	36	21	15	15	11	3.2	1.1
7	30-Sep-99	408021	1-2 ft	NA	NA	NA	31	13	7	11	7.8	2.0	0.86
8	30-Sep-99	408022	0-1 ft	NA	NA	NA	32	13	7.8	12	8.6	2.2	0.81
8	30-Sep-99	408023	1-2 ft	NA	NA	NA	30	12	7.2	11	7.9	2.0	0.79
9	30-Aug-95	358242	0-2 cm	16200	8940	305	50	45	21	18	16	4.1	0.3 U
9	23-Aug-98	398066	0-10 cm	14600	7275	NA	32	21	14	14	12	2.8	0.5 U
9	30-Sep-99	408024	0-1 ft	NA	NA	NA	33	17	10	13	9.2	2.3	0.94

Note: Detections highlighted in **BOLD**

NA = not analyzed

U = not detected at or above reported value

J = estimated value

UJ = not detected at or above reported estimated value

Appendix A-1. (continued)

Site No.	Date	Sample No.	Depth Interval	Silver	Beryllium	Thallium	Mercury	Antimony	Selenium	Cyanide
1	29-Aug-95	358246	0-2 cm	UPPER RIVER 0.3 U	NA	NA	0.01 U	NA	0.4 U	NA
2	23-Aug-98	398060	0-10 cm	0.66	0.24	0.38 J	0.012	4 UJ	0.3 U	0.10 U
3	24-Aug-98	398061	0-10 cm	PALMER LAKE - NIGHTHAWK						
4	30-Aug-95	358244	0-2 cm	0.78	0.28	0.50 J	0.018 J	4 UJ	0.3 U	0.10 U
4	24-Aug-98	398062	0-10 cm	0.30 J	NA	NA	0.012	NA	0.4 U	NA
5	30-Aug-95	358243	0-2 cm	0.83	0.38	0.3 U	0.029	4 UJ	0.3 U	0.10 U
5	24-Aug-98	398063	0-10 cm	0.30 J	NA	NA	0.01 U	NA	0.4 U	NA
5	24-Aug-98	398063	0-10 cm	0.59	0.24	0.3 U	0.031	4 UJ	0.3 U	0.10 U
6	24-Aug-98	398064	0-10 cm	EAGLE ROCK						
6	24-Aug-98	398064	0-10 cm	0.74	0.23	0.3 U	0.0085	4 UJ	0.3 U	0.10 U
7	23-Aug-98	398065	0-10 cm	ENLOE DAM RESERVOIR						
7	30-Sep-99	408020	0-1 ft	0.58	0.21	0.3 U	0.0072	4 UJ	0.3 U	0.10 U
7	30-Sep-99	408021	1-2 ft	2 U	1.3	0.3 U	0.013	5 UJ	0.3 U	NA
7	30-Sep-99	408021	1-2 ft	2 U	0.97	0.3 U	0.01 U	5 UJ	0.3 U	NA
8	30-Sep-99	408022	0-1 ft	2 U	1.2	0.3 U	0.01 U	5 UJ	0.3 U	NA
8	30-Sep-99	408023	1-2 ft	2 U	1.0	0.3 U	0.01 U	5 UJ	0.3 U	NA
9	30-Aug-95	358242	0-2 cm	0.3 U	NA	NA	0.012	NA	0.4 U	NA
9	23-Aug-98	398066	0-10 cm	0.73	0.23	0.3 U	0.014 J	4 UJ	0.3 U	0.10 U
9	30-Sep-99	408024	0-1 ft	2 U	1.1	0.3 U	0.01 U	5 UJ	0.3 U	NA

Note: Detections highlighted in **BOLD**

NA = not analyzed

U = not detected at or above reported value

J = estimated value

UJ = not detected at or above reported estimated value

Appendix A-2. Results from Analyzing Semivolatiles, PCBs, and Pesticides in Core Samples Collected behind Enloe Dam in September 1999 (ug/Kg, dry weight; only detected compounds shown)

Site No. Location Depth Interval (cm) Sample No.	7 Upper Reservoir		8 Middle Reservoir		9 Lower Res.
	0-30	30-60	0-30	30-60	0-30
	408020	408021	408022	408023	408024
Semivolatiles					
<u>Polyaromatic Hydrocarbons</u>					
Naphthalene	13	6.7 U	7.8 J	12 U	7.9 J
1-Methylnaphthalene	14	6.7 U	5.8 J	5.6 J	7.6 J
2-Methylnaphthalene	17	6.7 U	9.2 J	8.2 J	10 J
Fluorene	8.9 J	6.7 U	12 U	12 U	12 U
Phenanthrene	55	4.2 J	8.9 J	8.0 J	12 J
Anthracene	23	6.7 U	12 U	12 U	12 U
Fluoranthene	13 U	4.2 J	8.7 J	12 U	9.7 J
Pyrene	8.4 J	6.7 U	6.6 J	6.3 J	7.7 J
Benzo(a)anthracene	13 U	5.2 J	12 U	9.4 NJ	12 U
Chrysene	13 U	6.7 U	12 U	12 U	9.6 J
Total PAH	139	14	47	38	64
<u>Miscellaneous Compounds</u>					
2-Methylphenol	8.5	6.7 U	12 U	12 U	5.9 J
4-Chloro-3-Methylphenol	13 U	6.7 U	12 U	12 U	17
2-Nitroaniline	13 U	6.7 U	12 U	12 U	36
3-Nitroaniline	49	6.7 U	12 U	12 U	12 U
Dibenzofuran	12 J	6.7 U	6.4 J	6.3 J	7.0 J
Retene	522	7.9	83	48	203
Carbazole	1.2 J	6.7 U	12 U	12 U	12 U
Di-N-butylphthalate	3490 E	54 U	386 U	711 U	243 U
Butylbenzylphthalate	26 U	10	19 U	23 U	22 U
PCBs	ND	ND	ND	ND	ND
Chlorinated Pesticides	ND	ND	ND	ND	ND
Organophosphorus Pesticides	ND	ND	ND	ND	ND
Nitrogen Pesticides	ND	ND	ND	ND	ND

Note: Detections highlighted in **BOLD** NJ = evidence analyte is present; value is an estimate
 U = not detected at or above reported value E = estimated value that exceeds the calibration
 J = estimated value ND = not detected

Appendix B. Metals Data for Ecology Routine Monitoring Station 49B070, Similkameen River @ Oroville (ug/L)

Date	Arsenic		Cadmium		Chromium		Copper	
	Diss.	Tot. Res.	Diss.	Tot. Res.	Diss.	Tot. Res.	Diss.	Tot. Res.
09-Oct-95			0.04 U	0.1 U			0.609	0.7
11-Dec-95		21.6	0.04 U	0.1 U			2.51	10.1
12-Feb-96		1.94	0.02 U	0.1 U			0.972	1.5 B
15-Apr-96		3.6	0.077 J	0.1 U			5.21 J	5.2
11-Jun-96		6.27	0.022	0.1 U			1.39	6.3
13-Aug-96		3.78	0.04	0.1 U			0.846	1.3
15-Oct-96		2.77	0.019	0.1 U			0.759	1.1 J
10-Dec-96		1.9	0.019	0.1 U			0.48	0.7
15-Apr-97		2.04	0.02 U	0.1 U			1.21	2.3
10-Jun-97		8.28	0.02 U	0.1 U			1.44	8.7
12-Aug-97		4.18	0.02 U	0.1 U			0.881	1.1
15-Dec-98			0.02 U				0.554	
11-May-99			0.02 U				1.22	
02-May-00		3.4						
06-Jun-00		4.6						
11-Jul-00		2.1						
15-Aug-00	5.4	4.4						
05-Sep-00		3.3						
04-Oct-00		2.6						
08-Nov-00								
06-Dec-00								
17-Jan-01								
07-Feb-01								
07-Mar-01								
04-Apr-01	2.36	2.25						
09-May-01	1.6	2.35						
06-Jun-01								
08-Oct-02	3.09	3.07	0.1 U	0.1 U	0.42	0.5 U	0.81	0.99
03-Dec-02	2.06	1.93	0.02 U	0.1 U	0.75	0.5 U	0.51	0.75
04-Feb-03	1.73	1.61	0.02 U	0.1 U	0.3	0.5 U	0.74	1.01
08-Apr-03	1.64	1.7	0.1 U	0.1 U	0.5 U	0.5 U	0.5 U	1.39 J
03-Jun-03	1.5	4.33	0.02 U	0.1 U	0.25 U	1.3	1.18	4.57
05-Aug-03	6.37	5.61	0.02 U	0.1 U	0.4	0.5 U	0.77	0.98

B = The analyte was detected in the method blank.

U = The analyte was not detected at or above the reported result.

J = The analyte was positively identified. The associated numerical result is an estimate.

Appendix B. (continued)

Date	Lead		Mercury		Nickel		Zinc		Manganese	
	Diss.	Tot. Rec.	Diss.	Total	Diss.	Tot. Rec.	Diss.	Tot. Rec.	Diss.	Tot. Rec.
09-Oct-95	0.03 U	0.1 U	0.001 U	0.001 U	1 U	1 U	1.1	5.9 B	1.1	86
11-Dec-95	0.362	1.5	0.001	0.001	1 U	1 U	5 U	14.1 B	5 U	82
12-Feb-96	0.025	0.1	0.001 U	0.001 U	0.586	0.586	1.2 B	5 U	1.2 B	76
15-Apr-96	0.72 J	0.8	0.002	0.002	1.62 J	1.62 J	4.2 B	4.8	4.2 B	63
11-Jun-96	0.032	0.8	0.004	0.004	0.508	0.508	1.1	10.8 B	1.1	43
13-Aug-96	0.02 U	1	0.001 U	0.001 U	0.615	0.615	1	3.4 B	1	78
15-Oct-96	0.087	0.1 U	0.002 U	0.002 U	0.6	0.6	1.4 J	3.5 J	1.4 J	98
10-Dec-96	0.03 U	0.2	0.001 U	0.001 U	0.5	0.5	0.76	4 J	0.76	95
15-Apr-97	0.02 U	0.2	0.002 U	0.002 U	0.73	0.73	0.49	14.6	0.49	95
10-Jun-97	0.03	0.9	0.002 U	0.002 U	0.562	0.562	3.37	13 J	3.37	45
12-Aug-97	0.039	0.2	0.002 U	0.002 U	0.602	0.602	1.81	2.2	1.81	87
15-Dec-98	0.02 U		0.002 U	0.002 U	0.898	0.898	0.77		0.77	112
11-May-99	0.027		0.003	0.003	0.665	0.665	1.4 J		1.4 J	66
02-May-00										
06-Jun-00										
11-Jul-00										
15-Aug-00										
05-Sep-00										95.4
04-Oct-00										88.6
08-Nov-00										90.1
06-Dec-00										86.8
17-Jan-01										104
07-Feb-01										103
07-Mar-01										103
04-Apr-01										73.2
09-May-01										103
06-Jun-01										
08-Oct-02	0.02 U	0.14	0.002 U	0.002 U	0.49	0.81	1 U	5 U	1 U	46.7
03-Dec-02	0.036	0.1 U	0.0033	0.0033	0.73	0.71	1 U	5 U	1 U	94.6
04-Feb-03	0.02 U	0.1 U	0.002 U	0.002 U	0.39	0.46	1 U	5 U	1 U	97.8
08-Apr-03	0.02 U	0.11	0.004 U	0.004 U	0.62	0.91	1.1	5 U	1.1	81.4
03-Jun-03	0.041	0.44	0.0066	0.0066	0.39	1.33	1.3	5.7	1.3	79.4
05-Aug-03	0.02 U	0.1 U	0.002 U	0.002 U	0.54	0.66	1 U	5 U	1 U	38.3
										94.7
										38.3

B = The analyte was detected in the method blank.

U = The analyte was not detected at or above the reported result.

J = The analyte was positively identified. The associated numerical result is an estimate.

Appendix C. Site Locations and Other Information on Similkameen River Gold Dredge Samples

Site No.	Date	Owner	Site Description	River Mile	Dredge Description and Operation	Effluent Flow		Ecology Personnel
						Stream	Depth/Velocity*	
				Latitude		Substrate		
				Longitude*				
#1	1-Jul-04	Creegan	Approx. 500 ft. below BNR bridge, left bank	6.5 48 56 54 119 27 40	"Precision" dredge, 5" intake reduced to 4", 250 gpm pump, 6-8 feet off bank	1.2 cfs 2.5 ft. / 2.3 fps cobble w/ gravel & sand		Peterschmidt Johnson
#2	1-Jul-04	Lease	Approx. 100 yards below Eagle Rock, left bank	10.8 48 58 58 119 32 05	Custom, 6" intake reduced to 4", 1,200-1,500 gpm pump, 6 feet off bank	1.2 cfs 3 ft. / 0.9 fps cobble w/ sand		Peterschmidt Johnson
#3	18-Aug-04	Ching	S-turn @ irrigation canal crossing, left bank	13.7 48 59 15 119 32 25	Stilt mounted, 2.5" intake, 6.5 hp, working in streamside hole	no data 1.5 ft. / 1.4 fps cobble and boulders		Coffin Latham
#4	18-Aug-04	Sweeney	Approx. 1/2 mile upstream of S-turn, left bank	14.1 48 59 20 119 34 36	Floating dredge, 3" intake, 5 hp pump, 3 feet off bank	no data 1 ft. / 0.9 fps boulders		Coffin Latham
#5	18-Aug-04	Hard	Approx. 1 mile above Eagle Rock, left bank	11.1 48 58 51 119 32 24	Floating dredge, 4" intake, 5 hp pump	no data 3 ft. / 2.2 fps bedrock w/ fines		Coffin Latham
#6	19-Aug-04	Franklin	Above Eagle Rock, left bank	10.9 48 58 53 119 32 17	"Keene" dredge, 4" intake, 5 hp pump	no data 1.3 ft. / 2.5 fps cobble and bedrock		Coffin Latham
#7	18-Aug-04	Estes	Approx. 2 miles below Nighthawk left bank	15.8 48 29 12 119 33 58	"Keene" triple sluice, 4" intake, 300-450 gpm, 20 feet off bank	no data 1.4 ft. / 0.35 fps large cobble w/ fines		Coffin Latham
#8	18-Aug-04	Wade	River Oaks RV Resort, left bank	5.2 48 56 13 119 26 35	"Dahlke Polydredge", 4" intake, 300 gpm, 5 hp pump, 20 feet off bank	1.0 cfs 1.5 ft. / 0.5 fps cobble		Johnson Wittmeier

Appendix C. (continued)

Site No. Date Owner	Site Description	River Mile		Dredge Description and Operation	Effluent Flow		
		Latitude	Longitude*		Stream Depth	Velocity	Ecology Personnel
#9 19-Aug-04 --	Approx. 1.5 miles above Eagle Rock, left bank	13 48 59 08 119 33 39		3" intake, 5.5 hp pump, 20 feet off bank	0.2 cfs 1.3 ft. / 0.7 fps cobble and gravel		Peterschmidt Johnson
#10 18-Aug-04 Wade	River Oaks RV Resort, left bank	5.2 48 56 13 119 26 35		"Dahlke Polydredge", 4" intake, 300 gpm, 5 hp pump, 20 feet off bank	1.0 cfs 1.5 ft / 0.5 fps cobble		Johnson Wittmeier
#11 19-Aug-04 --	Approx. 1/2 mile above S-turn, left bank	14.3 48 59 20 119 34 50		Custom dredge, 4" intake, 5.5 hp pump, 30 feet off bank	0.4 cfs 2 ft. / 0.3 fps cobble		Peterschmidt Johnson
#12 21-Sep-04 Chase	"Boat ramp", left bank	13.3 48 58 50 119 32 32		Floating dredge, 4" intake, 7 hp pump, 10 feet off bank	0.5 cfs 1.5 ft. / 0.85 fps cobble and gravel		Peterschmidt Johnson
#13 21-Sep-04 Miltner	Approx. 1 mile above Eagle Rock, left bank	12.8 48 58 54 119 33 24		Floating dredge, 4" intake, 5.5 hp pump, 10 feet off bank	0.4 cfs 0.9 ft. / 1.3 fps cobble w/ gravel & silt		Peterschmidt Johnson
#14 22-Sep-04 --	Approx. 1 mile below Enloe Dam, left bank	8.5 48 57 41 119 29 46		Floating dredge, 2.4 inch intake, 6.5 hp pump, 15 feet off bank	-- -- boulders		Peterschmidt

*NAD 27

†immediately upstream of dredge intake hose

Appendix D. Results on Laboratory Duplicates for the Similkameen River Gold Dredge Study (laboratory splits)

Sample Type/ Sample No.	Ambient River Water		Dredge Effluent	
	274080	274080-dup. RPD	344230	344230-dup. RPD
Tot. Rec. Zinc (ug/L)	1.6	2.3	3.6	3.5
Tot. Rec. Copper (ug/L)	2.4	2.5	4	3.2
Tot. Rec. Lead (ug/L)	0.12	0.15	22	0.40
Tot. Rec. Arsenic (ug/L)	3.7	4.0	8	7.1
Dissolved Zinc (ug/L)	1.0	1.1	10	N/A
Dissolved Copper (ug/L)	0.82	0.83	1	N/A
Dissolved Lead (ug/L)	<0.02	<0.02	0	N/A
Dissolved Arsenic (ug/L)	2.8	2.8	0	N/A
TSS (mg/L)	10	10	0	N/A
Turbidity (NTU)	3.7	4.2	13	N/A
Hardness (mg/L)	52	52	0	N/A

RPD = relative percent difference (range of duplicates as percent of duplicate mean)

N/A = not analyzed

**Appendix E. Results on Field Blanks for the Similkameen River Gold Dredge Study
(ug/L)**

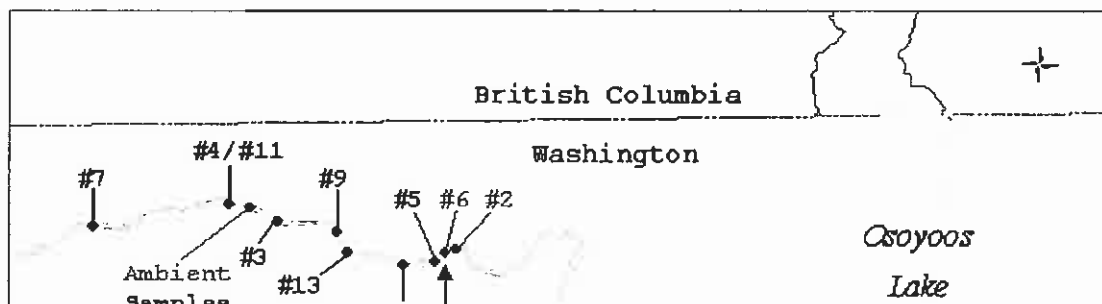
Sample Type	Date	Zinc	Copper	Lead	Arsenic
Bottle Blank	30-Jun-04	<1.0	<0.10	<0.10	<0.10
Filter Blank	"	0.56	<0.10	<0.02	<0.10
Bottle Blank	18-Aug-04	<1.0	<0.10	<0.10	<0.10
Filter Blank	"	1.1	<0.10	<0.10	<0.10
Bottle Blank	21-Sep-04	<1.0	<0.10	<0.10	<0.10
Filter Blank	"	<0.50	<0.10	<0.02	<0.10

Samples for the gold dredge study were collected on June 30 - July 1, August 18 - 19, and September 21 - 22, 2004. Monthly average river flow during this period typically ranges from 3,029 cfs (July) to 616 cfs (September).

The first set of samples corresponded to the July 1 opening of the mineral prospecting work window. The second sample set was collected during a Resources Coalition dredge rally held in Oroville on August 18 - 22, an event designed to generate interest and improve understanding of small-scale gold dredging. The third sample set was intended to assess dredging impacts during September low flow.

Ambient Samples

Background concentrations for the metals and other parameters of interest were determined by analyzing water samples collected in the Similkameen River approximately 3 ½ miles below Nighthawk (Figure 5). This location is in the upper part of the reach where most dredgers work. The ambient samples were collected on June 30, the day before the opening of the dredging season, and again in the early morning of August 19 and September 22 before dredgers began working the river.



STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
704 Lewis Building
Portland, Oregon

Placer Mining on the Rogue River, Oregon, in Its Relation to the Fish and Fishing in that Stream

By

Dr. HENRY BALDWIN WARD, Consultant

An Ecological Study Made for the
Oregon State Department of Geology and Mineral Industries
September, 1937 - May, 1938



STATE GOVERNING BOARD

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GENERAL CONSIDERATIONS

INTRODUCTION

In August, 1937, I was consulted by Mr. Earl K. Nixon, director of the Oregon Department of Geology and Mineral Industries. He stated that the governing board of that department desired to arrange for a study of the effects of placer mine washings on the runs of valuable fish in the Rogue River. Mr. Nixon assured me that the Board had no desire to confirm fixed views but sought to ascertain the actual facts in the case and would welcome the most careful and complete study of the river whatever might be the results of such a study.

Shortly after this conference I received an invitation from the Board to undertake the work in accordance with the general understanding reached in my interview with Mr. Nixon. The month of September was spent partly in Portland conferring with various persons officially interested in the work on the Rogue River, and in part on the river. This was the low water period of the year. Further studies were made on the river at high water stage in March and early April, 1938; following that, the results of my work were discussed in Portland with the director and others.

A preliminary report was submitted last October. At that time as a basis for final conclusions I recommended the periodic collection of water samples at different places on the Rogue and the determination of turbidity and of erosion load throughout the year at points above the entrance of placer mine run-off and also below that. It was agreed that such tests be carried out at Grants Pass and at Agness.

During September I had been granted the assistance in the field of Mr. A. M. Swartley of the department. His intimate knowledge of the area and broad professional experience in geology proved of great service in the study of the river conditions and their probable origin. At the conclusion of our work together, Mr. Swartley wrote an extended report on the physiographic features of the region. From this valuable record I present herewith a part of Mr. Swartley's manuscript having a particularly intimate relation to the biological studies and conclusions reached in my own report. Mr. Swartley's section appears as Appendix A.

I also recommended that experiments be made to measure the effects on young salmon and trout kept for some time in water heavily loaded with mud from placer mining projects. Accordingly Mr. Nixon arranged with Dr. L. E. Griffin to carry out such experiments in his laboratory at Reed College. A summary of Dr. Griffin's important experiments is given with his permission in Appendix B. It is important here to emphasize one conclusion of Dr. Griffin: namely, that these few preliminary experiments should be carried further. The general results secured cannot be questioned, but their unique character and their importance both practically and scientifically call for their repetition in the light of experience gained in order to determine the limits, if any, within which the conclusions are to be accepted. I am indebted to Mr. Swartley and to Dr. Griffin for the privilege of including sections of their reports in my own.

Before I started on a study of the river the complaint filed with the court by citizens of Curry county was placed in my hands. Careful and repeated study of this document familiarized me with the views of the complainants regarding the condition of the river, the state of the fisheries and the alleged cause of the conditions which were described in detail in the document. This presentation of the case was kept constantly in mind; the region was studied with care and no trouble was spared in my efforts to determine the accuracy of the report and the justification for the opinions advanced. The various items included in that complaint are discussed later in my report in connection with the analysis of the situation as I found it.

My problem was to determine how far and in what way the fish of the Rogue River and its tributaries were affected by the placer mine run-off. No other region was to be considered; no other type of mining was to be taken into account. I was free to ascertain the facts in the situation and to make known all the facts which might be discovered in my study without suppressing or modifying any of them to meet the views of any of the apparently conflicting interests involved. I have tried to justify the responsibility laid upon me and hope that I have succeeded in some measure in discharging that responsibility.

THE ROGUE RIVER

The Rogue River rises in the Cascades of southern Oregon; its headwaters drain the entire western slopes of the ridges which encircle Crater Lake. For about 250 miles among mountains and hills it pursues a circuitous course trending southwest before it empties into the Pacific Ocean at Gold Beach. The region has long been known for the beauty of its scenery, the fertility of its orchard-filled valleys, the abundance and quality of its fish. First of all in the record of history was the fame of its gold-bearing sands and gravels which were extensively exploited by early settlers and have continued with varying activity to yield of their riches to those engaged in placer mining. No records have been found giving accurate data concerning the condition of the water in those early days. We may be sure that workings so extensive as were operated then discharged into the river considerable volumes of the same material that characterizes the run-off today. Indeed, it is reported by early navigators along this coast that the outlet of the river could be detected by the volume of reddish-yellow water which it poured out and which could be followed for a considerable distance into the sea before it mingled indistinguishably with the ocean waters.

Only one published record has been found of previous analyses made of water from the Rogue River. This was printed in Water Supply Paper 363 (U. S. Geol. Survey, 1914). The table given there covers a period from September 10, 1911, to August 14, 1912, and the samples were taken near Tolo (now Goldray). It represents conditions in the stream far above placer mining operations, hence due entirely to natural erosion. The suspended matter varied from 3.6 to 1,360 tons per day and the dissolved matter from 239 to 2,328 tons per day. The turbidity varied from a trace to 350 scale units and the curve of variation in turbidity departed somewhat widely from that of the amount of suspended matter present. Thus the maximum turbidity recorded was observed in the period July 16-25, whereas the maximum of suspended and dissolved materials was obtained on January 8-17. The volume of the river fluctuated also widely, as shown by variations in the mean discharge from 1,141 to 14,134 second feet. Though this record covers a single year only, it shows wide and also rapidly fluctuating conditions to which

the fish in it have been and still are subjected by nature.

The geography, geology, climate, water supply and floods in the Rogue River valley are succinctly discussed in the introduction to Water Supply Paper 638-B (U. S. Geol. Survey, 1932) on the Water Power Resources of the Rogue River Drainage Basin, Oregon. No further discussion of these features is needed here. The data given in this bulletin are of value in determining the significance of the additions to the normal stream flow as the results of placer mining operations.

ROGUE RIVER FISH AND FISHING

The Rogue River has long been held in high esteem as a salmon stream. It has been visited annually by many fishermen from Oregon and from other states and records of their sport, printed in various magazines devoted to travel and outdoor life, have given it truly an international reputation. Some years ago I met on the Rogue the treasurer of the International Olympic Games Committee who had come from England to test his skill on the far-famed salmon and steelhead of that stream. In 1930 I myself published in *Outdoor America* an article in which I dwelt on the beauty of the stream, the abundance and fine quality of its fish and its high value as a recreational center for Oregon and its visitors. Many other similar articles might be cited.

Only three species of anadromous fish contribute in significant numbers to the fame of the river: the chinook salmon (*Oncorhynchus tshawytscha*), also known as king, Columbia River, or quinnat salmon; the silversides (*Oncorhynchus kisutch*), also called coho, or silver salmon; and the steelhead (*Salmo gairdnerii*), commonly classed as salmon trout and regarded by ichthyologists as the sea-run form of the rainbow trout (*Salmo irideus*). Of interest to the fisherman are the various trout of the Rogue system. These do not run to the sea and are not further considered in this report.

It has been customary to speak of separate runs of spring and fall chinooks and of summer and winter steelheads. These are not always clearly separable and their spawning periods are either identical or closely continuous. Structurally the varieties cannot be separated and differences in movement and other activities vary with exact climatic conditions. They are not known to be

affected differently by factors discussed in this report.

No one knows when salmon or trout first came to the Rogue River, but it seems probable that the salmon spawned at the foot of the retreating glaciers of the Ice Age and followed up the cool run off of the disappearing ice masses until their spawning grounds became as today: "These species of anadromous fish ascend the river to the highest point attainable before making their spawning beds, seeking the waters that are purest and coldest." (Wharton—*The Rogue River*)

The first settlers found the stream teeming with the same fish that are present today in lesser numbers. Testimony of the former abundance of salmon is given by many brief references in early records which though apparently extreme in phraseology are nevertheless proof that the fish in their annual migrations appeared in enormous numbers. That these numbers have been greatly reduced in the last 75 years is unquestionably true. But the same is true in every region and probably in every stream from California to Alaska. Increase in population and consequent modifications in natural conditions, multiplication in number of fishermen and "improvements" in means of capturing the fish, better means of transportation and economic pressure are among the factors which have multiplied many times the hazards facing the fish. As one scans the long list of perils that confront the fish in fresh water and in the sea, from the start of life to its finish, should we not rather marvel that despite all so many survive to multiply and maintain the race?

The river was once the seat of an extensive commercial fishery. From the records of the Oregon State Fish Commission it appears that the commercial catch in the years 1929-1933 inclusive was 185,775; 194,269; 267,766; 528,384; and 346,962 chinook salmon alone. In 1934 the catch was 174,006, and the river was closed to commercial fishing June 13, 1935. During all this period the steelhead was rated as a game fish and was not legally taken except on hook and line. Large meshed nets employed in commercial fishing insured a nearly total escapement of the steelheads and also of all save the largest silver salmon, although in the years 1929-1933 from one to 42,000 silversides were taken annually, or on the average in that period nearly 15,000 a year. Since the time when the Rogue was closed to commercial fishing in 1935,

all the fish captured have been taken legally only by sport fishermen limited in season and to the use of hook and line alone. But no record of the catch is required and no figures can be given to measure the present size of the run. Estimates are subject to individual prejudice and are of limited value. In considering the present supply one must bear in mind furthermore that the time intervening has not been long enough to demonstrate the results of this remedial measure. It is well known that the curve of destruction descends sharply, but the curve of recovery rises very slowly at the start.

MUDDY WATER

The Rogue has always carried loads of silt. The extent of its drainage, the depth of its valleys, the amount of water-worn material in its area, and the drop of several thousand feet in its course of 250 miles to the sea, as well as the consistent testimony of explorers and settlers during the last century, give evidence of marked fluctuations in volume of stream flow and in clearness and turbidity of its waters.

All the evidence that has been obtained justifies the conclusion that no present-day contributions of materials produced by bank erosion differ in character or exceed in amount those added periodically by purely natural processes in past times. Splendid runs of salmon and steelhead were established and maintained under truly natural conditions which certainly were on occasion more extreme and violent before man ever came into the picture than they are today. Furthermore, there is good reason to believe that placer mining run-off was larger in amount and more continuous in the early years of that industry when for a time at least greater areas were being mined, more men were at work and cruder, more violent methods were followed than are employed today.

Somewhat later the best deposits seemed to have been exhausted, new discoveries of gold elsewhere drew attention away from this region. More recently social and economic changes have led to new interest in this resource and to renewed activity in Rogue River valley placer mining. Even at that the industry has not apparently assumed the proportions of that first period. This is important in our discussion as indicating that conditions today do not exceed and probably do not equal those which the fish met naturally before our nationals invaded this valley and also during that earlier period of pioneer mining activity.

CHANGES IN THE RIVER AFFECTING FISH LIFE

The river is modified and the life and habits of the fish in its waters are affected by such changes as are produced by human agencies. To be sure no one can think rightly of the stream itself as a constant environment. On the contrary it is undergoing continual change. The amount and location of winter's snowfall, the volume and time of seasonal rains, the duration and precise period of regional droughts, and other climatic variations produce variations in water level, in bank erosion, in growth of grasses, underbrush and trees in the drainage basin; thus sudden and often extreme changes in contours of the banks and surrounding country add sediments of different types to its waters and modify the conditions under which the fish it harbors are forced to live.

Similar changes which are not so easily seen take place in the bed of the river. Each flood cuts deep holes at some places and fills up such holes elsewhere; materials picked up at one point are sorted as the current varies and deposited at many different points. No region is spared, for even solid rocks are deeply grooved or broken and moved about as time passes. During my study of the river in March a tremendous slide at one point poured tons of material into the stream and blocked its course for days. In the past history of the valley such occurrences have often recurred and interfere violently with the gradual though slow disintegration of rocks and soil which are constantly adding to the environmental materials on which weather and water may work in tearing down and upbuilding the different areas in the valley.

Coming from the spring-fed slopes of high mountains, its waters were cold and pure. Its rapid descent and its rocky banks with frequent rapids in its course loaded the water with a rich supply of oxygen. The heavy forest cover of its shores in primitive days served to maintain the low temperature and high oxygen supply of its waters.

Thus the Rogue River furnished originally unsurpassed conditions for the development and perpetuation of large and fine races of the anadromous fishes. The coming of man has wrought many changes in the environment which have been clearly unfavorable to the fish. These changes have been (1) the construction of dams; (2) the building of diversion ditches; (3) the development of agricultural interests, such as farms, orchards, forests,

nurseries; (4) the organization of towns and cities; (5) the establishment of factories and industrial enterprises. Probably in point of time before any of these, came placer mining with its violent overturnings of natural soil.

All of these enter into relations with the river which necessarily modify its original character. The changes are usually made without consideration of their effect on the stream as the home of the fish and in most instances affect unfavorably the welfare of those and other forms of aquatic life. It is important to consider in detail the precise relations involved and the results of the changes made.

Dams interfere with the upstream migration of the adult fish. Under natural conditions the fish penetrate into the smaller tributaries and upper reaches before depositing eggs and milt. To avoid interference with the migration of the fish, dams are provided with fish ladders, the construction and condition of which are all important factors. The dams in the Rogue, at Savage Rapids and Goldray, are equipped with ladders, but at the time of my visit they were not operating well. More extended study would be required to determine whether this was only a temporary condition and how far it affects the welfare of the fish. The same conditions were reported by Ledgerwood who studied the river in August, 1936 (see below). No special devices were found to aid the young fish in their journey down stream. It looked as if the migrating young would be drawn into the turbines and destroyed. No study was made of this problem.

Dams also modify the natural temperature of the river water. This factor was studied in August, 1936, by Edgar Ledgerwood, from whose report to the Oregon Fish Commission the following data has been taken. Above the obstructions the temperature of the river water rose on the average 1° F in 6 miles. At Goldray dam it mounted to 3.5° F in one mile, and at the Savage Rapids dam, while average daily temperatures remained about equal, the minimum was raised about 2° F, and the water in the fishways reached 72° F, a level distinctly unfavorable to salmonoid fishes.

When cooler water from lower levels behind the dam is drawn into turbines and discharged through a tailrace, this stream of lower temperature proves a strong attraction to adult fish ascending the river in search of spawning grounds. The fish attracted to the tailrace fight, of course in vain,

to find access thus to upper levels and many attempts have been made to bar them from this stream. Similar deceptive streams start from leaks at lower levels in dams and draw the fish away from ladders that have been constructed to furnish them access to the water above the dam. As ladders are naturally fed by surface water from the basin behind the dam, they carry a stream warmer than the flow from the tailrace and from leaks near the base of the dam. Under these circumstances the adults are at least delayed, if not injured, on the trip to the spawning grounds, but as yet studies have not been made to determine the loss due thereto.

The plans proposed by the Reclamation Service (Bull. U. S. Geol. Survey 638-B) for transforming the stream into a power-producing element by constructing 34 possible dams, or even part of the maximum efficient number, would undoubtedly entirely destroy the runs of salmonoid fishes and close the career of the Rogue as a rendezvous for fishermen.

Diversion ditches have also modified natural conditions in the Rogue River. The wide open entrance of such a ditch with its inflowing current invites the entrance of aquatic animals, and particularly those living near the surface or feeding along the shore. This includes especially young fish, either fry or fingerlings, seeking to descend the stream and escape into the ocean. Even older fish such as spawned-out steelheads, moved by the same impulse for the sea, will at times enter such ditches. That such is the case abundant testimony can be furnished. Young fish have been watched often entering such ditches, moving freely down the current, accumulating in deeper holes when the water was shut off, or found dead in irrigated fields. They are seen in miners' settling basins or power-plant reservoirs, are torn to shreds in turbines or ejected with water from the nozzle of a giant. It is immaterial whether the diversion ditch serves a power plant, an irrigation project, a mining enterprise or some other purpose, the fish, young and old, which enter it are condemned to destruction. While the number tempted to enter at any particular moment may be small, it must be remembered that such ditches work day and night until shut off and the total count of fish destroyed is unquestionably large. Most of these conditions I have observed personally on the Rogue and these

observations have been confirmed by testimony of others.

Recognizing this serious loss, Oregon has provided by law that the intake of diversion ditches must be screened so as to prevent the entrance of fish. At the Savage Rapids dam an expensive screen has been installed to prevent fish from entering the ditch which takes a large volume of water out of the river. No study whatever was made of the efficiency of this installation, but even casual observation of other ditches showed some to be entirely without protection as well as others in which the screen as placed was worthless. These conditions are responsible for a large and preventable loss in the fish supply of the Rogue River.

Changes in the valley due to human occupation and necessary modifications are significant and in part not usually recognized. The cultivation of farms, orchards, nurseries, and all other agricultural activities, save forestry alone, break up the sod, destroy the underbrush, dry out the soil, drain marsh areas large and small, reduce the capacity of the land to serve as a holding ground for water, hasten the run-off of rain and melting snow, heighten erosion; and all of these influences react unfavorably on the stream as the home of the fish. These conditions are too well known and too often discussed to call for further notice here.

One other feature is less widely recognized and deserves mention because of its intimate relation to the welfare of salmonoid fishes. The diversion of river water through ditches, its dispersion over fields, and slow return to the river by seepage channels results in raising the average daily temperature of the river during the dry summer season. This is certainly significant in the case of a stream like the Rogue where the water temperature at this season is near the upper limit of tolerance for salmonoids. One can hardly doubt that the water of the river is on the average warmer in summer now than it was 100 years ago before the cutting of the forests, the mining of the soils and the creation of farms began. These changes are inevitable, but no one would wish it otherwise. Some modifications of natural conditions must be accepted if the land is ever to be made useful for human homes and the prosperous existence of man. Temperature conditions in the Rogue River have not yet changed sufficiently to make the river unsatisfactory for fish life, but the destruction of forests around its sources and on the

mountainous areas of its lower reaches will certainly threaten its supremacy as a famous fishing ground and should be controlled with the utmost care.

The influx of population into the valley of the Rogue led as elsewhere to the organization of towns and cities, and also to the establishment of industrial plants, such as canneries, factories, packing plants, and other establishments which yield considerable amounts of waste that as usual are discharged into the streams. These materials are often distinguished as domestic sewage and industrial wastes, but are actually not separate types. Under present day conditions both are ordinarily mixed and discharged through collecting systems, i. e., municipal sewers. These wastes contain organic materials in process of disintegration or chemical substances which are by-products of industrial plants. The latter are often toxic in character and the former take up oxygen with such

avidity that the water of the stream is deprived of this essential element. Either condition is serious and in the extreme case fatal to the fish. Young fish are most sensitive to these as to other unfavorable conditions.

The establishment of sewage treatment plants by the larger communities in the Rogue valley has been adequate to meet present dangers. The stream is now free from toxic chemicals and the oxygen content is adequate at all points tested. But the growth of other communities, the establishment of isolated canneries or manufacturing plants and the use of industrial processes involving chemicals of a toxic nature may discharge into the river at any time untreated wastes which will seriously threaten the welfare of the fish. Such occurrences in other regions have resulted in the sudden destruction of large numbers of fish. It would be deplorable if ever such a misfortune befell the Rogue.

PRESENT CONDITION OF ROGUE RIVER SYSTEM

MY SURVEY AT LOW WATER

The relations of any organism to the environment are complex and the relative importance of any single factor difficult to determine definitely. Superficial conditions are always most apparent but often of minor significance if any in the solution of a given problem. The first step is necessarily the precise determination of the facts at issue. Only after those have been precisely determined can the causal relations be profitably discussed. At the outset of my study I was forcibly impressed by the mass of wild statements current regarding the condition of the river and the fish. Even among those who lived near the river, fished at all seasons in its waters, knew the pools and the habits of the fish and were not influenced by relations that might warp their judgment of actual conditions, there was wide difference of opinion regarding the condition of the river and the number of fish as well as the cause of changes which all agreed had taken place.

It was of primary importance to settle if possible some of the facts in dispute and my attention was first directed to the river. Since the most serious complaints came from the part of the stream which was below the points at which placer mine run-off reached the main river, it was decided to begin the study near the mouth and work up stream. The work started the first of September and at that time the river water stood at or near the lowest level reached in the course of the year. Placer mining in the district had stopped some weeks earlier; stored up water supplies had been drained and no rain had intervened to complicate the situation. In consequence the river water was remarkably clear and free from products of erosion, the current ran slowly, pools were drained down so that the flowing water rippled lazily over gravel bars. One could see with clearness the records of earlier water levels on the banks and bars and read from a boat the actual condition of the bottom in all save the deepest spots in the pools. No period could have been more favorable for determining the real condition of the stream and the deposits made at various levels.

A trip was made on September 6 in a fishing boat from Gold Beach to Agness. I was accompanied by Mr. Nixon and Mr. Swartley. Evidences

of stream activity at various periods were sought for with great care. Floating materials stranded high on the banks marked the extreme limits of high water; more abundant deposits were found in back waters, on shelving beaches above the existing water level and reaching down to the margin of the water; even on the stones in the pools one could find evidence of stream deposits of recent date. From point to point we landed on the shore, studied the features noted, measured the thickness of the deposits, determined roughly the materials of which the deposits were composed, scraped samples from the surface of the larger stones in protected corners where the covering was thickest and discussed together the amount and origin of these deposits. I made extended field notes on the color, thickness, consistency and physical character of these deposits as well as of the areas involved and their relations to rocks, promontories and direction of stream flow. Since these deposits had occupied a prominent place in statements both written and oral regarding the condition of the Rogue, extreme care was devoted to recording every detail of the situation that could be found.

The area covered by these deposits was conspicuous. As the river channel shifts from bank to bank the deeper water forms a series of crescentic areas reversed in direction and joined at the tips (Fig. 1). The crescents vary in proportions but are essentially uniform in type. The shore which faces the concave side of the crescent has usually a longer, gentler slope (Fig. 2) and these beaches which showed clearly the deposit were from one to several times the area of the low-water river itself. They formed thus conspicuous features of the landscape. On some of them were prominent longitudinal bars of coarse gravel sharply set off from the stream (Figs. 3, 4). In other places the slope of the beach was longer and gentler. Sometimes rocky headlands (Fig. 5) or strings of smaller rock masses along the shore broke up the formal pattern to some extent (Fig. 6). In sheltered spots behind such rock masses one could find deposits of almost pure sand, varying in depth from half an inch to a foot or more, but in number and total volume such deposits were small in comparison with the length of the stream and the area within the high-water marks on the banks.

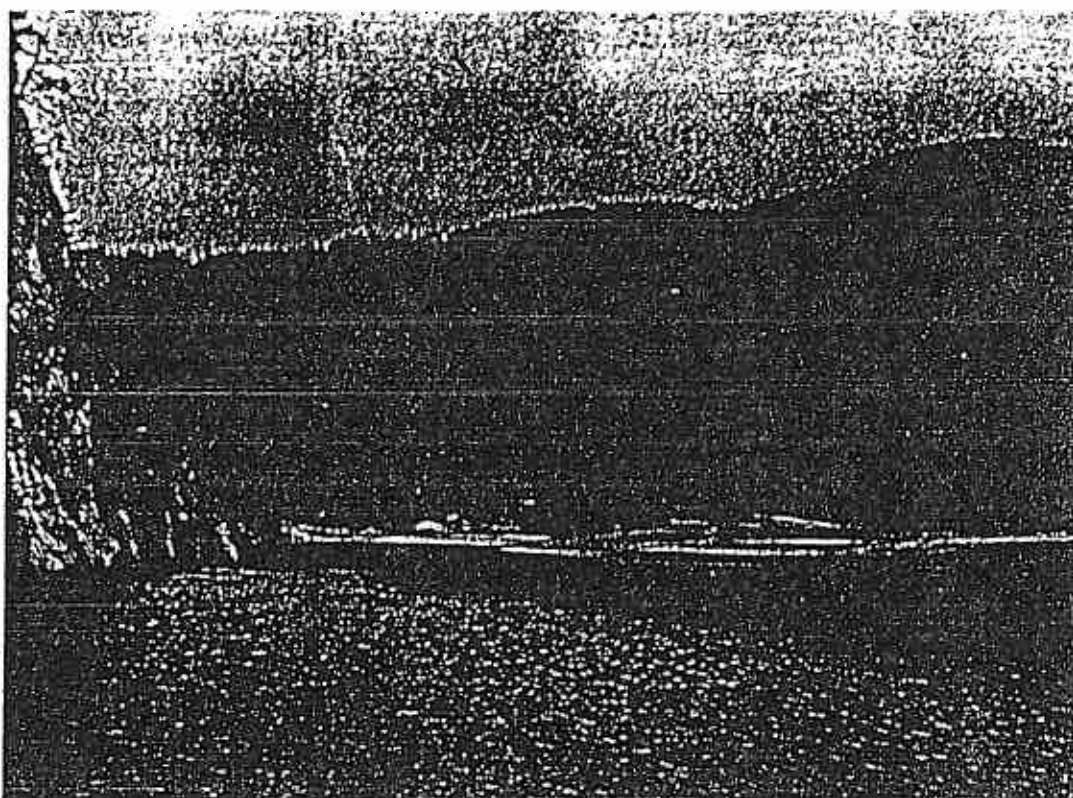


FIGURE 1—View of riffle where one crescent of river connects with the reversed crescent next below.

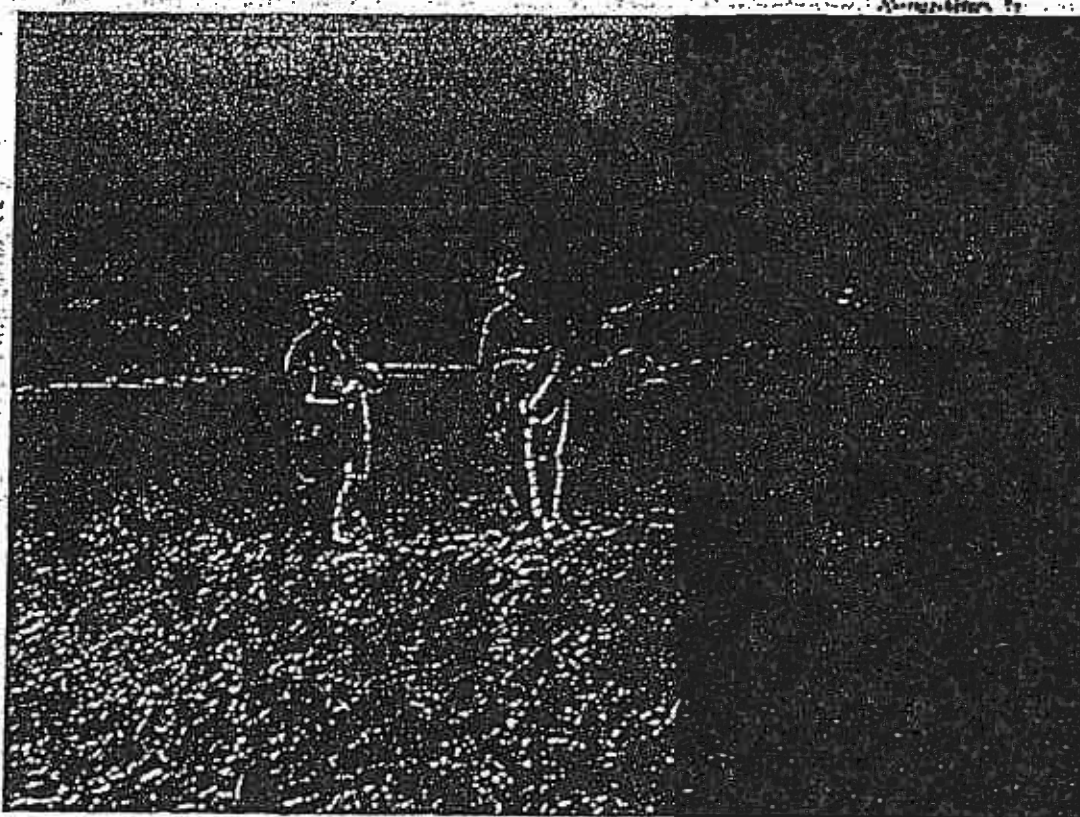


FIGURE 2—Wide, gently sloping beach between high and low water levels on Rogue River near the mouth of the Illinois.

The area within which rocks and stones were covered by the material deposited from the river water was not only considerable in extent but it was conspicuous by virtue of the color of the deposit. That was of a pale reddish yellow hue varying somewhat in intensity or density of coloring but still of a characteristic shade in sharp contrast with the clear greenish water and the darker green of the vegetation or the dull colors of the rocks. In fact, as we rode up stream in the motor boat such areas came out with striking distinctness at every bend when we passed from one pool to the next and the sloping beach with its painted stones was shifted from side to side. No one observing the situation could fail to be impressed with this as the most conspicuous feature of the landscape. Apparently the deposit stopped just at the water's edge, but closer observation showed that stones under water were covered with a similar deposit that needed only to be dried out to attain the appearance of that on the stones of the bank above the water level. At one extreme, stones that were not coated at all or only faintly were located at or near the upper limits of the high water, showing that the material was not present in equal amount or the conditions for its deposit were not favorable at maximum high-water level. But by contrast over the lower half, more or less, of the interval between high water and lower water limits all the stones on the sloping beaches and even the rocky promontories and steep rock faces, which in a few places margined the stream, were colored similarly by this conspicuous deposit.

The amount and character of the deposit was also carefully studied. We landed often and examined at close hand the stones of the beaches, sought to measure the thickness of the deposit on stones at varying levels and in different areas along the course of the river. It varied more in amount than in color; at some points it was so thin that only with difficulty could a sample be scraped off the stone even with the aid of a knife. On rough, broken, nearly vertical rock surfaces the color was distinct, but the material too scanty to get any sort of a sample. Under unusually favorable conditions flat stones lying fairly level carried a layer of the deposit estimated to be 1/16 of an inch thick. In one place, namely in a backwater behind a large rock where there was a considerable deposit of sand, I found a crust about 1/8 of an inch thick. It was so friable or "crumbly" that portions could hardly be removed without breaking up into

powder even under careful manipulation. The surface of the crust was like that on the stones, but it graded without visible boundaries into the sand below, and as the crust was lifted grains of sand fell off leaving some still loosely connected to the upper part in which also some sand grains could be seen. At the first attempt to follow up the structure of the crust, it collapsed into a mass of loose sand grains with a small quantity of a fine powder. When still undisturbed on the surface of the sand or on stones where it was much thicker and devoid of larger sand grains, the surface of the crust was traversed by a multitude of small furrows running in every direction and reaching down into the crust. These furrows divided the crust into small, irregular blocks measuring 1/2 inch or less in maximum diameter. They resembled in miniature the broken surface of dried-out mud. The crust has thus scanty volume, imperfect continuity, and little or no adhesion or cohesion.

Samples of this material were obtained at different times from points on the Applegate River, from both forks of the Illinois River, from various creeks tributary to these or the Rogue, and at numerous places on the Rogue River itself. In gross appearance the samples were alike and manifested similar physical characteristics when handled. At most one could note only slight differences in the color of the dry sample.

When samples of this crust were added to water, thoroughly agitated and left to settle, the sediment settled out in 24 hours, but the water was still colored and held in suspension a small quantity of very fine material. After standing 44 hours the water was perfectly clear. When tested this water showed a very small amount of colloid material which could not be measured in any such rough determination. It probably agreed substantially in amounts with the exact measures given in the Lazell determination (see later). All of these tests show that the amount of colloidal material in the water of the Rogue River and its tributaries below the point at which the run-off of placer mine workings has been added to the stream is too small to produce on the bottom a "blanket" which might affect adversely young fish, eggs in nests if present, or the fish food in the water.

I have discussed this deposit at length so that its character may be clear even if its source is uncertain. It may be derived from natural erosion and it may come from placer mining as artificial erosion. It is more likely to come in part from each

of those sources. However that may be it is not entitled to be called a "blanket" or to be charged with injurious or destructive influences on the fish life of the river. Certain fresh water formations are designated "blankets" because they cover the bed of the streams or lakes so thickly or imperviously that they smother the aquatic life there and prevent its multiplication as well as its growth. Thick cohesive mud layers, deposits of petroleum refining wastes or of some other chemical industries, sludge from domestic wastes and similar substances form continuous, resistant, impermeable layers which rightly are designated as "blankets". Their physical, chemical, and ecological differences from the deposit I have just described in detail are too evident to call for further analysis.

During the month of September our study was extended to cover the Rogue River and its tributaries. The work was carried to points well above all traces of placer mining and of all influences of human interference. Throughout this period conditions were uniform; minimum water level, sluggish current, lack of suspended materials and consequent clear water in the river at all points made it possible to investigate deposits, food supply, and general conditions for fish life thoroughly and reach some definite conclusions. Sewage treatment plants visited at Grants Pass and Medford were being operated well and no evidence was found that domestic or industrial wastes had been released without proper treatment. No extensive or dangerous deposits of any sort were seen at any point. Even below the points at which tributaries entered from areas in which placer mining had gone on at earlier months in the year, no changes from normal conditions were observed. The pools sheltered migrating fish; they were also seen in the stream below the dams, and a normal supply of fish food was found at various points visited. While the fishermen reported scanty catches, or none at all, this condition was apparently due to inactivity on the part of the fish, and that might well be attributed to the plentiful food and lack of stimulating weather.

The data just given summarizes results of the work done in the field last September. That was the period of low water, little or no precipitation and no placer mining. It was deemed important to study the river at the time of high water when the mines were in full operation. The preliminary report submitted at this time was regarded as subject to modification on the basis of later studies.

ROGUE RIVER SYSTEM AT HIGH WATER

Conditions found on the second visit, during March and April, contrasted strongly with those just described during September, 1937. The water in the river was very high and remained at a high level during my entire stay. Consequently observations on fish and their activities were limited. It was impossible to secure any data on spawning grounds below Grants Pass. However, at that stage of water the fish were hardly likely to stop for spawning in areas where the depth and strong current made conditions so unfavorable. The placer mines were operating actively and the run-off was a conspicuous feature in smaller tributaries and at points on the main river also.

The water supply of the placer miners was about at its maximum and consequently the run-off and its burden of soil materials washed out by the operations were also at a high level. Accompanied by Director Nixon and in some cases by Dr. Griffin also, I visited some of the largest and most active of the operations. Samples of the run-off were taken at points where the stream was first turned out from workings into a watercourse and then at points farther down the creek in order to determine how rapidly the original concentration was diluted. The results of these studies are discussed in a later section of this report. In general it was evident that the amount of material in suspension was reduced more rapidly than the appearance of the water changed. The color of the run-off coming from those workings being carried on in brilliant red deposits was particularly persistent while the amount of material in suspension (ppm) fell off rapidly.

An examination of the Rogue and its tributaries made at a period intermediate between high and low water would disclose, no doubt, some features of the situation not determined at the time of either visit I made to the region. Indeed it would be valuable to continue a study of the stream throughout the entire year. Such an investigation would furnish a solid foundation on which to build regulations for preserving and developing rightly all of the resources of the region. Without such a complete record of the changes from one period to another and of the varying relations between different influences the exact effect of the work done on a single resource can only be roughly determined. The proper solution of all the complex factors involved can only be found by securing

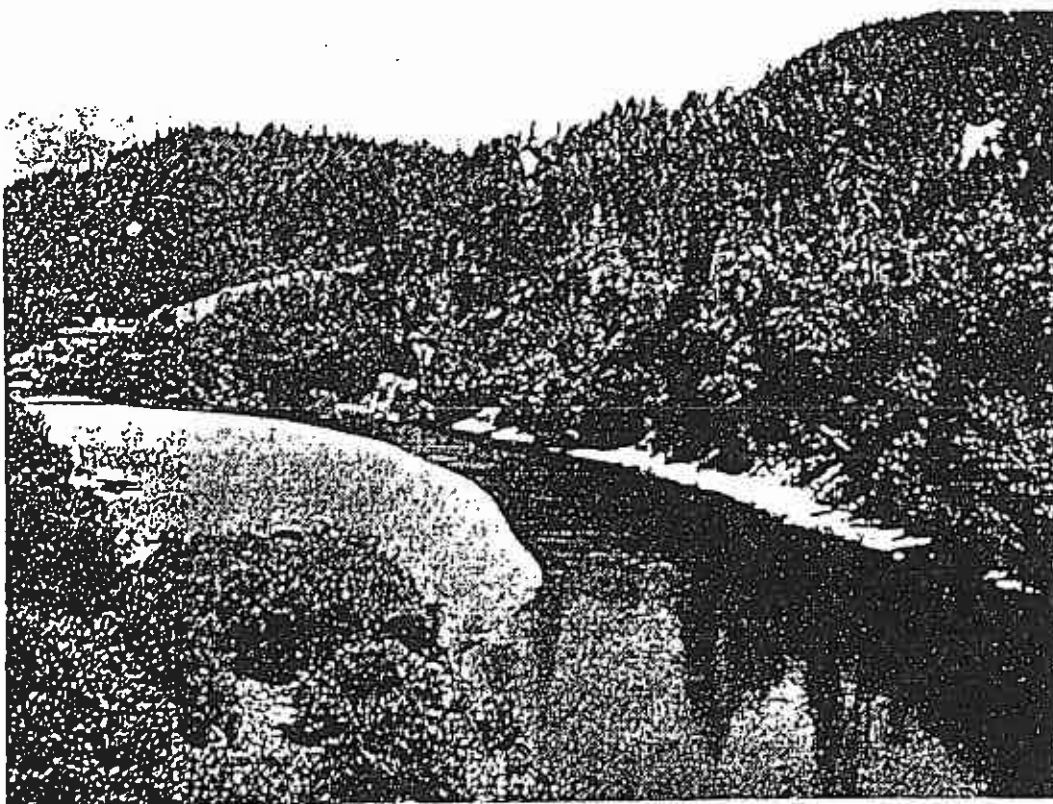


FIGURE 3—Crescent of river above bridge at Agness showing beach with sharper bank at low-water level

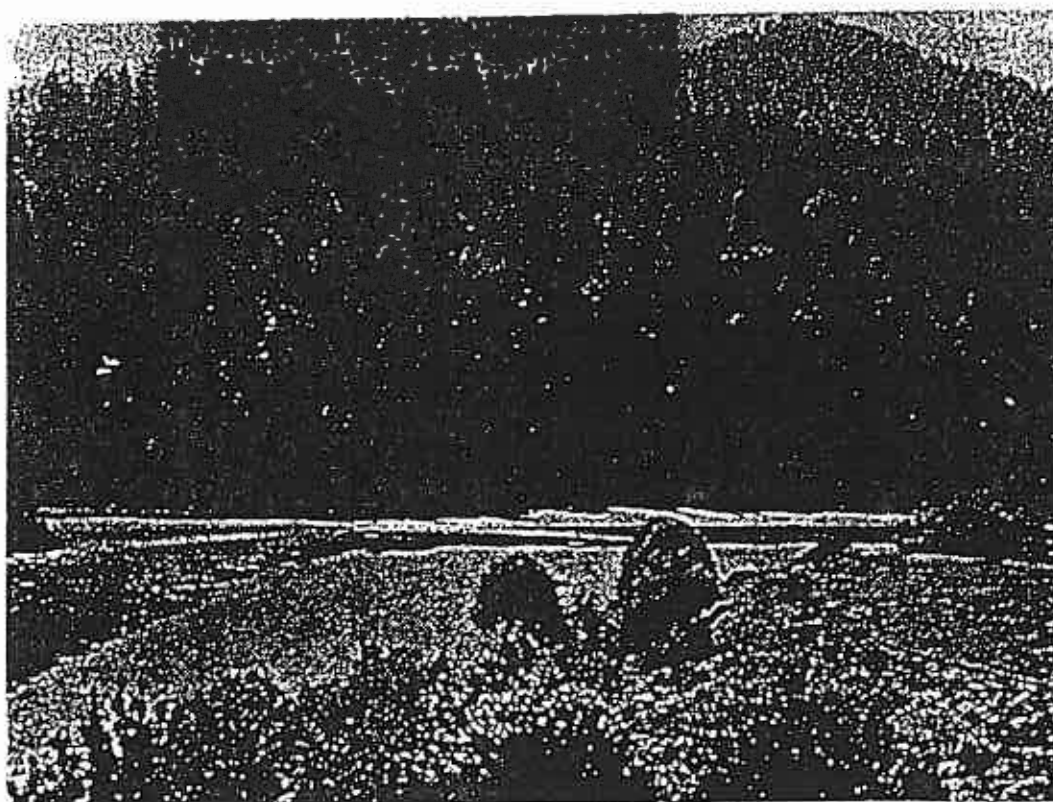


FIGURE 4—Crescent with longitudinal bar of coarse gravel on outside of curve and higher rocky bank with vegetation inside curve. Taken at junction of Rogue and Illinois rivers.

much larger knowledge and more perfect coordination of all interests involved.

In connection with this section giving the record of the survey made on the Rogue River it is appropriate to call special attention to the value of the assistance given me in different parts of the work. It would not have been possible to start the study and carry it out so promptly without the personal attention afforded me by Director Nixon. Frequent discussions with him enabled me to follow up details I wished to study without loss of time. His frankness in recognizing the dangers in the situation and his constant efforts to find a fair solution of the problem made his assistance inspiring as well as constructive.

The supplementary report of Mr. A. M. Swartley, who aided me in the part of the survey made in September, 1937, is of value in giving the views of a careful and experienced geologist. He confirmed fully statements I had reached in my preliminary report as to the physical conditions found in the Rogue River drainage, and especially the small amount of clay and other fine material on shores and stream bottoms, in backwaters and otherwise in our examination of the river and its tributaries. He discussed fully the methods of rock disintegration and decomposition and the transportation and ultimate character of the materials produced. He emphasized the fact that mining debris "is chemically inert, makes no oxygen demand on the stream and therefore takes away from the flowing water nothing which the fish require. This is equally true of this material whether placed in transit by nature or by man since [the products] are alike in nature, come from the same sources and are only being accelerated by man in their journey to the sea." Further he stated, "All these materials entering the streams, whether by natural or human activity, whether coarse or fine, whether traveling on the bottom, in suspension or solution, are almost altogether inert, suffer little change on their way to the sea, and having reached the end point of chemical change . . . do not rob the water of oxygen which the fish demand, or add to the water toxic agents injurious to fish" [fish food or other forms of life]. The portion of this report printed as Appendix A includes only a few of the items of special importance in connection with features I am discussing in this my own report.

The appended summary in Appendix B of experiments by Dr. L. E. Griffin on young fish in

water carrying a heavy load of natural soil materials gives strong support to the conclusions from stream study. The mud came from the placer mining region in the Illinois River drainage basin; the fish were of species found in the Rogue River basin.

These experiments are unique. To be sure adult fish have been kept in water loaded with sawdust and with pulp or paper mill waste, so that much has been ascertained concerning the effects of certain types of material on adult fish. Also a long series of valuable experiments has been conducted by Shelford and his students on the effects of particular chemicals on adult fish. Further in Oregon, Finley and his associates have tested the results of placing young salmon in diluted municipal wastes and found the fatal effects of such an environment to be almost immediate.

In contrast with all these the experiments of Dr. Griffin have shown that young fish live well up to 30 days in good water mixed with an amount of natural soil materials from two to three times as large as the extreme load of the materials contributed to the Rogue River by maximum conditions produced by placer mining. These findings are discussed later in greater detail.

PLACER MINING AND WELFARE OF FISH

It is essential now to consider with exactitude the process of placer mining, the character of its by-products or materials discharged into the streams in the Rogue valley and the effects on the fish of the river at all periods in their life history and under the varying conditions in the stream at different seasons. In this consideration we are concerned only with those features designated properly as biological that have some influence direct or indirect on the life of fish. Problems involved in the construction and maintenance of dams and diversion ditches have been given adequate mention in the earlier portions of this report.

Placer mining is pursued in the Rogue River district by dredging and by sluicing or hydraulicking. The dredges are employed in only a few places and on extensive level areas where settling basins are provided. Under these conditions the final run-off as discharged into the Rogue or some tributary is free from silt and consequently may be left out of further consideration here.

Placers which are mined by hydraulicking and sluices are located in rough territory, very often in narrow gulches where settling basins are me-

chanically impossible so that the run-off passes into the Rogue River directly or into a tributary from which it ultimately reaches the main stream. The water used is usually obtained by a diversion ditch which taps some tributary at a higher level and is thus in itself of fine quality. Accordingly the character of the run-off is determined by the materials in the soil which is broken up by the action of the water employed. The water carries a heavy burden of soil materials regularly designated as waste. In a large part of this region the run-off is highly colored and criticism has been particularly violently directed at the conspicuous and persistent color contributed to the stream. All of the materials involved deserve further consideration.

Attention must first be directed to the various meanings attached to the word waste or wastes. In mining, waste is "superfluous or rejected material not valuable for a given purpose". In physical geography, waste is defined as "material derived by mechanical and/or chemical erosion from the land, carried by streams to the sea." Wastes may thus consist of or include materials unchanged in nature or those which have been chemically altered, i. e., natural constituents of the soil or new substances produced by chemical action. The placer mine run-off is waste in the sense that it is superfluous and unserviceable material, but it is not material that has been modified by processes of manufacturing or chemical treatment. The placer mine run-off is composed of good water and normal unaltered soil; it carries no materials that can rightly be called *deleterious substances*. This distinction is fundamental and should be emphasized.

To designate placer mine run-off as pollution is a confusion of terms. Neither in dictionary definition nor in scientific analysis can the use of this term be justified. To pollute is to defile; to contaminate with wastes of man or animals; this is done by introducing domestic or community wastes, or such as are produced in manufacturing and industrial processes. Chemically these include toxic materials or unstable compounds which have a high affinity for oxygen and withdraw promptly so much oxygen from the water that they threaten the life of organisms in it. Trout and salmon prefer waters which are surcharged with dissolved oxygen and they are sensitive to any diminution in the oxygen supply. They are also sensitive to domestic and industrial wastes, i. e., foreign substances. But the substances carried in the water

coming from placer mines are those common to the soil of the region. They are stable compounds and make no draft on the oxygen content of the waters. Washings from placer mining have been poured into the Rogue River in quantities since 1850 and even when the stream was crowded with the immense runs of salmon, which characterized it in earlier days, the fish found these waters favorable for their existence; they maintained their runs.

Evidence of the character and effect of erosion materials is given in an important publication on the Detection and Measurement of Stream Pollution (Bulletin U. S. Bureau of Fisheries, No. 22; 1937) by Dr. M. M. Ellis, in charge Interior Fisheries Investigations. On page 432 Dr. Ellis points out that erosion silt has no effect on streams (a) in decreasing dissolved oxygen, (b) in increasing acidity, (c) in increasing alkalinity, (d) in increasing specific conductance, (e) in increasing ammonia, or (f) in specific toxic action on fishes. In his tabulation of effects under the headings of bottom pollution blanket and increase in turbidity, he indicates that erosion silt and other suspensoids have a critical limit which is discussed in detail at another point in his paper (p. 394). The dangers which he sets forth there are not one of them present in the Rogue River, as I shall proceed to show in detail.

In the Rogue River I have already noted the absence of any continuous layer of erosion materials which could possibly be designated as a blanket, or cover fish foods, nests or spawning ground with an impermeable layer. Cole (1935) has demonstrated experimentally that fish move uninjured through very muddy waters. Swartley in his supplementary report gives a table of the amount of suspensoids recorded in a group of streams, some of which are good salmon rivers; these carry from 137 to 395 ppm of solid materials and have turbidities varying from 27 to 245. In his experiments Griffin maintained for some weeks young salmon in good condition in water containing more than 1000 ppm of mud from placer mine areas in the Rogue River valley, whereas the maximum amount actually found in water taken from the river at Agness was 440 ppm (See Table II, p. 21).

Placer mining does not burden the stream with foreign materials or with substances that are toxic or inimical to fish life. Its processes contribute to the normal burden of the stream the same materials which are brought down from the hillsides of this area and no substance is involved which is

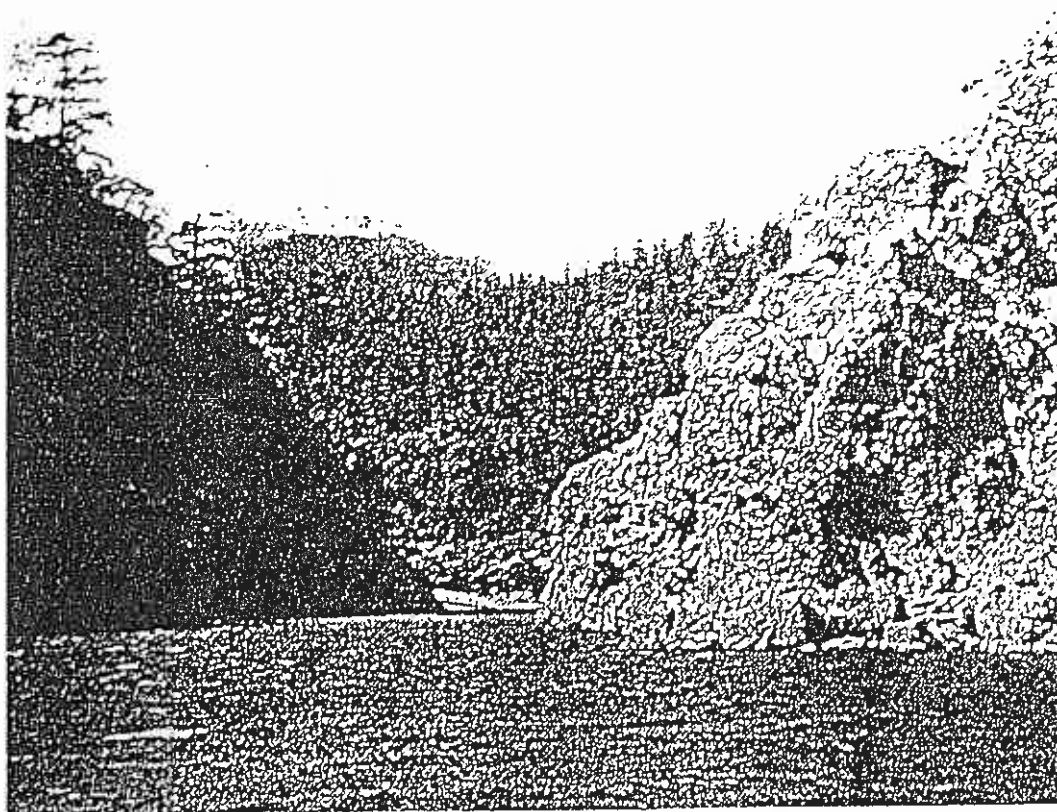


FIGURE 5—Bold rocky promontory. Rock marked by color of thin layer of deposit below high-water level.

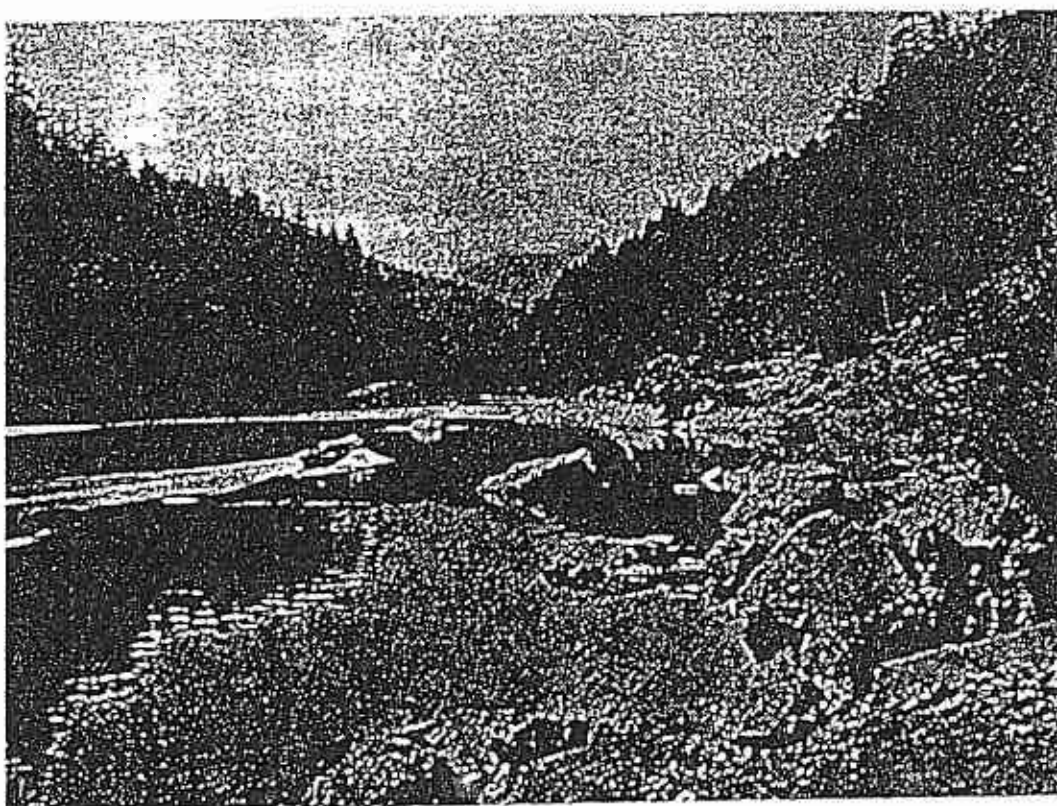


FIGURE 6—Scattered rocks along shore with bed of sand in right foreground.

foreign to the materials the stream has carried for centuries. Not one of the particular materials listed or discussed by Ellis in his paper as constituting stream pollution hazards is found in the placer mine run-off of the Rogue.

An analysis was made of the dried soil from placer mines used in making the muddy water experiments carried on by Dr. L. E. Griffin (see Appendix B). The analysis was furnished by Dr. E. W. Lazell of Portland Chemical Laboratories. The protocol of this test follows:

Laboratory No. 39058.

Alumina 15.24%

Total Sulphur .002% equals .005 sulphuric anhydride.

Settling Test

Time	Percent in Suspension	Particle Size Microns
2 hours	0.15	40
6 "	0.048	22
24 "	0.027	9
48 "	0.25	5

The particles remaining in suspension 48 hours are amorphous, having no action on polarized light.

Assuming 5 microns as the maximum size of a mineral colloid, the maximum amount would be .025%.

The material of which this analysis was made was taken directly from banks on which placer miners were working or had been working. The placer mine run-off secures its load of suspensoids from the same banks that furnished this material and has no other source of the material it carries.

Actually the process of placer mining adds no new material to the water of the river and produces no change in the aquatic environment except in quantity of soil materials found in the river at a given time. Now the exact amount of such material in the river has changed often radically and rapidly during each year in the past history of the river. Natural variations in climate make natural erosion work variable and with rapid and unpredictable as well as violent changes at unexpected intervals as well as from season to season. So long as materials remain of the normal type found in local soils the quality of the water is unimpaired and neither old nor young fish suffer. We can find no way to distinguish between the effects of placer mining (artificial erosion) and those of rain and flood (natural erosion). They differ at most only in degree and intergrade at different stream

levels. Both comparative data from other streams and experimental evidence with placer mud from the Rogue River area seem to indicate clearly that the limit of tolerance has not yet been reached here. As the stream flow in the river tapers off seasonally, the drop in miner's water reduces somewhat similarly the run-off from the placer mines, so that the concentration is not likely to exceed the amount employed experimentally without harm to the fish.

The run-off from placer mines in the Rogue River area is characterized by its deep red color which is strikingly persistent as well as conspicuous. This is a finely divided iron compound, probably iron rust, a stable compound, and contrary to common opinion in the region, not in the least injurious to the fish. It may contribute to the opacity of the water and perhaps also makes it difficult for the fish to see the fly, although Dr. Griffin found that young fish readily saw and promptly captured food thrown into the tanks in his experiment. However, if the fish cannot see or are not attracted by the caster's lures, the condition of the water may reasonably be said to protect the fish, even though it disappoints the fisherman!

TURBIDITY OF ROGUE RIVER WATER

The turbidity of the Rogue has been measured regularly by Mr. Edward N. McKinstry, engineer of the waterworks at Grants Pass. I am indebted to him for the following data which cover the hydrogen ion concentration (pH) as well as the turbidity of the stream during the period October, 1937, to May, 1938, inclusive. These data are recorded daily at that station and give a very good picture of the condition of the river above the region in which it receives the run-off from placer mining operations. The determinations of turbidity are recorded there by visual comparison with standard solutions made from water and fuller's earth in accordance with specifications of the La Motte Chemical Company. This method is recognized as standard for such analyses, and is widely used. At the same time I wish to call especial attention to the fact observed by several of us independently: the color of the sample affects the result, indicating a higher apparent turbidity than actually exists. (See Table I)

Turbidity samples were taken from the Rogue River at Agness from January to April inclusive

and are given in the following table. These represent the condition of the river water after all contributions of placer mine run-off have reached it. These samples were delivered to the Department in Portland and the determinations were made by Dr. L. E. Griffin. (See Table II)

In March Dr. Griffin accompanied Director Nixon and myself in a survey of the chief points in the Rogue River valley at which placer mines were operating at that time. Samples of the run-off were taken at the seat of operations and in the small streams at places between the workings and the Rogue River. The determinations of turbidities in these samples were made by Dr. Griffin later. In all determinations he used a photo-electric cell apparatus constructed by Professor Day of Reed College on the general principle of that described by Ellis in *Science*. These determinations, though accurate for practical purposes, were found to be influenced by the color of the sample. (See Table III)

Comparison of these records with those of the river at Grants Pass shows that only two (Nos. 10 and 12) taken on small streams close to workings were in excess of the concentrations recorded this year for Grants Pass where no placer mine contributions were involved. Sample No. 13 from Coyote creek equals the Grants Pass maximum for the past winter as recorded on February 6; the next largest sample we took (No. 6) came from the middle of Fry creek near O'Brien with 630 ppm; it only barely exceeds the second Grants Pass record this winter, viz, 600 ppm on March 23, while at No. 7 only one-eighth of a mile down stream from the point of No. 6 sampling this concentration had fallen from 630 ppm to 165 ppm and 450 feet further down stream it had dropped to 105 ppm much below concentrations observed on various dates at Grants Pass during this winter. (Compare Table I with Table III)

The extremes of concentration of placer mine run-off which we could find were represented by

TABLE I
DETERMINATIONS OF ROGUE RIVER WATER AT GRANTS PASS

Date	Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May	
	pH	Turb.	pH	Turb.	pH	Turb.	pH	Turb.	pH	Turb.	pH	Turb.	pH	Turb.	pH	Turb.
1	7.3	8	7.3	15	7.1	15	7.2	20	7.1	50	7.3	30	7.1	20	7.1	2
2	7.3	8	7.1	12	7.1	15	7.2	15	7.1	45	7.1	30	7.1	20	7.1	3
3	7.1	8	7.1	10	7.1	15	7.1	30	7.1	150	7.1	30	7.1	20	7.1	3
4	7.1	8	7.3	10	7.1	12	7.3	15	7.1	60	7.1	30	7.1	20	7.1	2
5	7.1	8	7.3	10	7.1	10	7.2	15	7.3	30	7.1	30	7.1	20	7.1	2
6	7.3	10	7.3	10	7.1	10	7.1	15	7.1	700	7.1	15	7.1	15	7.1	2
7	7.1	12	7.4	10	7.1	10	7.1	10	6.9	500	7.3	15	7.1	10	7.1	2
8	7.3	12	7.3	10	7.1	10	7.1	10	7.1	325	7.3	15	7.1	10	7.1	2
9	7.7	10	7.3	10	7.0	7	7.1	25	7.1	100	7.3	10	7.1	10	7.1	1
10			7.3	10	7.1	30	7.1	10	7.1	85	7.1	10	7.2	10	7.1	1
11	7.5	10	7.1	50	6.9	350	7.1	10	7.1	85	7.1	10	7.1	10	7.1	1
12	7.3	10	7.1	75	7.0	225	7.1	10	7.7	50	7.3	10	7.1	10	7.2	1
13			7.1	30	6.9	60	7.1	12	7.1	60	7.3	15	7.1	10	7.1	1
14	7.1	8	7.1	30	6.9	40	7.1	20	7.1	270	7.1	15	7.1	10	7.1	1
15	7.1	8	7.1	50	7.1	30	7.1	80	7.1	80	7.1	15	7.1	10	7.1	1
16	7.1	8	7.1	25	6.9	25	7.1	35	7.1	40	7.1	160	7.1	10	7.1	1
17	7.4	8	7.1	20	7.1	20	7.1	40	7.1	35	7.1	60	7.1	15	7.1	1
18	7.1	12	7.1	70	7.1	18	7.1	225	7.1	35	7.1	45	7.1	15	7.1	1
19	7.1	12	7.1	200	7.1	15	7.1	80	7.1	35	7.1	200	7.1	35	7.1	1
20	7.1	12	7.1	400	7.1	15	7.1	35	7.1	35	7.1	80	7.1	35	7.1	1
21	7.1	12	7.1	90	7.1	15	7.1	30	7.1	35	7.1	35	7.1	35	7.1	1
22	7.1	12	7.1	25	7.1	12	7.1	100	7.3	25	7.1	50	7.1	20	7.3	1
23	7.5	12	7.1	40	7.1	10	7.1	80	7.1	25	7.1	600	7.1	20	7.3	1
24	7.3	12	7.1	25	7.1	20	7.0	35	7.1	60	7.1	225	7.1	20		
25	7.5	12	7.1	20	7.0	10	7.0	20	7.1	50	7.1	160	7.1	18		
26	7.3	12	7.1	15	7.1	10	7.0	15	7.1	45	7.1	50	7.1	18		
27	7.3	12	7.1	15	7.1	15	7.1	10	7.1	40	7.1	40	7.2	18		
28	7.3	11	7.1	15	7.1	12	7.1	10	7.1	40	7.1	40	7.1	15		
29	7.3	11	7.1	15	7.1	90	7.1	12			7.1	35	7.1	12		
30	7.5	11	7.1	15	6.9	80	7.1	10			7.1	80	7.1	20		
31	7.1	10					7.1	10			7.1	25				

* From E. N. McKinstry, Grants Pass.

sample No. 10, just below the sluice of the Fry pit, with 7,840 ppm and No. 12, at the escape of a working on Coyote creek, with 38,000 ppm. In both cases the concentration was greatly reduced on the small stream a short distance below the point of actual discharge. Fish were seen in Coyote creek above the point of entrance where the sample was taken; they probably had ascended the creek and had passed through the water, although the discharge may not have been as heavy at the time when they went up that section of the creek as it was at the time that sample No. 12 was taken.

EFFECTS OF SILT ON FISH

Popular opinion cherishes an old and widespread belief that sawdust, silt, and similar solid

particles carried by flowing waters clog the gills of fish and kill them by suffocation. This opinion is apparently sustained by frequent discovery on streams or banks of dead fish in which the gills are crowded full of fibers and masses of floating materials identified as sand, paper, and pulp-mill waste, etc. Since these materials came apparently from mines and industrial plants, the responsibility for the destruction of the fish was at once charged to the specific industries. The discussion has long waged violently around the lumber, paper, and pulp mills. It is now clearly recognized that those wastes are dangerous because of the toxic substances discharged with the mill wastes or the decay set up in accumulated masses of such wastes, and not in any degree because of any damage due

TABLE II
TURBIDITY DETERMINATION OF WATER
TAKEN AT AGNESS
(Made with photo-electric cell by L. E. Griffin)

Date	Turbidity			
	January	February	March	April
1	.....	130	65	73
2	.....	120	103	65
3	.....	210	106	68
4	.....	150	120	77
5	.....	108	76	65
6	.....	250	95	.....
7	.....	267	75	.....
8	.....	440	60	.....
9	.....	153	57	.....
10	.....	157	70	.....
11	.....	152	65	.....
12	.....	156	76	.....
13	.....	168	75	.....
14	.....	175	67	55
15	.....	87	128	57
16	62	•	285	54
17	70	•	220	74
18	55	•	165	68
19	100	135	215	123
20	125	90	180	107
21	127	89	136	76
22	155	88	•	65
23	103	106	•	54
24	135	122	•	56
25	112	125	•	.....
26	102	103	142	.....
27	175	75	134	.....
28	50	70	100	.....
29	60	.....	100	.....
30	103	.....	65	.....
31	55	.....	54	.....

* No sample submitted.

Determinations of pH also were made of 10 samples, all of which were 7.0.

TABLE III
REPORT ON SEDIMENT CONTENT OF SAMPLES
TAKEN MARCH 26, 1938

	pts per million
1. From stream at first bridge beyond Ruch, 2.8 miles below summit of hill west of Jacksonville..	475
2. East fork of Illinois River at first bridge on Highway 199, south of Caves Junction	25
3. West Fork of Illinois River. Taken on west bank 50 feet above bridge. First West Fork bridge on Highway 199, south of Caves Junction	30
4. From bank of West Fork of Illinois River, opposite entrance of Fry Creek, 200 feet above steel bridge east of O'Brien	10
5. Taken in West Fork of Illinois River, 2 feet above bridge (same as 4) on east bank of river, below entrance of Fry Creek into Illinois River..	600
6. From middle of Fry Creek, 75 feet above its entrance into Illinois River	630
7. From east side of Illinois River, ¼ mile below Fry Creek. Taken from small side channel of river. Water here heavily colored by Fry Creek discharge; other side of river clear	165
8. From west bank of Illinois River, about 450 feet below 7	105
9. From west bank of Illinois River, 1,550 feet below bridge. (Same as 4.)	97
Numbers 5-9 form a series showing how rapidly the discharge of Fry Creek becomes diluted in the Illinois River. At point 9 the discharge of Fry Creek seems to be evenly distributed in the river. Above this point it was heavier on the east side of the river.	
March 28, 1938	
10. Sample taken from pool just below sluice of the Fry pit, 1.9 miles above steel bridge and Illinois River. Mine in operation with water flowing through sluice	7,840
11. Taken from stream at bridge 54, at Bridgeview. Althouse Creek	30
12. From end of flume at pit working on Coyote Creek, on left of road, operated by Cleveland. Fine bright red soil. Very fine material, much colloidal stuff apparently	38,000
13. At Coyote Creek bridge on Highway 99. 2.5 miles below point where sample 12 was taken ..	700

to floating particles. Some of the evidence for this may be given.

In 1899 Professor Prince, fish commissioner of the Dominion of Canada, a scientist of high standing at home and abroad, wrote as the conclusion of years of travel and observations on lakes and streams in different parts of Canada, "so far as our present knowledge goes, sawdust pollution, if it does not affect the upper waters, the shallow spawning grounds, appears to do little harm to the adult fish in their passage up from the sea. * * *

There is no case on record of salmon or shad, or any other healthy adult fish being found choked with sawdust, or in any way fatally injured by the floating particles". This pronouncement was amply sustained by the researches of Dr. A. P. Knight of Queens University. He began investigations in 1900 and in his first preliminary experiments reported in 1901 found that trout, though badly injured when placed in a mixture of sawdust in water as thick as gruel were healthy and active after two weeks in it. Post mortem examinations showed no trace of damage from sawdust. In a final report published in 1907, he presented at length the results of other observations and experiments on the problem. While his work dealt only with sawdust, the conclusions reached are so significant that I quote some of them *verbatim*: "1. Strong sawdust solutions poison adult fish and fish fry through the agency of compounds dissolved out of the wood cells. 2. The overlying water in an aquarium containing sawdust does not at first kill fish. After about a week it does kill, but solely through suffocation, the dissolved oxygen having all been used up."

In other words floating particles do not damage the fish; but products of decaying organic matter and toxic materials are destructive.

More recently the problem has been studied by Cole (1935) with reference to pulp and paper mill waste. He kept fish three weeks in a gruel-like mixture of pulp. On the basis of his work he states (p. 301), "as long as the fish remained healthy and active their gills were kept clean. * * * It was only when fish were dying that the fibers clogged their gills."

I have myself often observed dead fish with the mouth and gills filled with masses of floating debris which were taken in with the last feeble respiration movements when energy was not sufficient to force the material out through the gill slits. To avoid error and confusion in the mind of

the reader, it must be emphasized that sawdust accumulating in streams does serious damage to fish life, but only by the production of toxic materials that are absorbed in the water and by the exhaustion of free oxygen through decay. Similar effects follow the discharge of pulp and paper mill wastes. However, as floating particles in water neither the rough granular masses of sawdust nor the fibrous elements of wood pulp damage the gills or are accumulated on the gills of healthy fish.

It has also been stated that harsh materials such as sand or grit will injure the surface of the gills or accumulate and clog the passage ways. On careful consideration of conditions this appears most unlikely. The abrasive action of such gritty substances is exerted only when they are forced down on surfaces by pressure from behind. Bathing is familiar with the fact that sharp sand and gravel, although carried by a strong current, do not injure or even irritate the soft skin of the human body. Even in a mixture of a density equal to more than 1,000 ppm, the amount of rough solids is so small that the cushioning power of the volume of water is adequate and mechanical injuries are fully prevented.

Fish live and thrive in rivers carrying large loads of silt. One could make a long list of such streams in the central West and on the slopes of the mountains between that region and the Pacific coast. To be sure, all of these do not have salmon runs, but they do carry trout and up to recent times those affording suitable conditions were the home of the grayling, which is clearly more sensitive to adverse conditions than salmon.

Between California and Alaska are many streams which are seasonally, and some of them constantly, loaded heavily with silt that comes from glacial run-off and from bank erosion. Such streams include those which under undisturbed conditions—i. e., before human interference affected the numbers and environment of the salmon—carried large numbers of these fish every year. It has been impossible to secure from the reports of explorers, surveyors, engineers, or government bureaus which have studied these streams and have recorded the heavy loads of materials in suspension which they carry, any precise mathematical data to compare with those obtained for the Rogue River. Nevertheless the descriptions given show reasonably clearly that the amounts of silt in some of these rivers at least were larger than that found in the Rogue at any time. Engineers

and other experienced men have in personal discussion borne positive testimony to this view, both as to the relative amount of silt and as to the presence of vigorous and healthy fish.

I have myself seen and studied numbers of such rivers in the United States and in Alaska which rank among the well-known salmon streams of the west coast and which are heavily loaded with sediments. I shall confine myself to more precise statements of one region. The Copper river in Alaska has been one of the famous salmon streams of that territory. It has a large number of tributaries which come out of mountain ranges east, north and west of the Copper River valley. Some years ago I had opportunity to visit the upper reaches of some of these rivers where the salmon spawn under what at that time were undisturbed natural conditions. Some of these streams were clear, but others were heavily loaded with glacial detritus. I have seen among these Alaska rivers in which salmon run and spawn some so heavily loaded with mud that one could not trace the body of an adult salmon ascending the river even when the dorsal fin cut the surface of the water. Yet the fish examined on the spawning grounds just before and just after death showed that the gills had suffered no injuries on the way though the body had met with conspicuous external damage through violent contact with sharp rocks at rapids or falls or along the shore. The examination was made in connection with the study on the cause of death after spawning and all organs were closely inspected. The gills were reported as apparently in perfect condition. Although the object of the investigation was not to determine the effect on the gills of silt-loaded waters, still, if any evident injury had been present, it would have been noted. The journey from the sea up the Copper and its tributary was long and strenuous; the chance for damage to the salmon from muddy water was certainly large if any damage could be wrought by such conditions, and yet none was observed. Many other similar cases could be cited from printed as well as personal records.

The long period of past time in which the salmon of the Rogue had been subject to the influence of heavily silted waters in that stream and the persistence of a run large in numbers and unsurpassed in quality serves to confirm the views expressed above on the basis of other evidence. The adult fish are not injuriously affected by up-

stream migration through water as heavily loaded with silt as is the Rogue River.

Strong as this argument is, it must take second place to the results of the experiments on young fish which I suggested and which have been carried out so well by Professor Griffin. His results are fully stated in Appendix B. In further comment I desire to call attention first to the fact that these experiments were performed with young fish. Despite their far greater sensitiveness to changes in environment and susceptibility to injury, the young salmon lived heartily in a concentration of sediment which was at its minimum (760 ppm) twice as much as the maximum recorded at Agness (see Table II). Indeed the average amount of turbidity in Griffin's experiments was ten times the average recorded at Agness. Those who think that normal erosion products will prove injurious to such fish should examine carefully the records in these tables.

EFFECT ON SPAWNING GROUNDS

Erosion silt in some streams has been found to cover nests and spawning grounds with a blanket such that the bottom fauna was killed and eggs also were suffocated in nests. In these ways such a deposit does great damage to the fish population in a stream. Unquestionably this is serious in some places and under some circumstances, and it is important to examine the situation carefully in the Rogue River. This was one of the first items to which I devoted my attention in making the study of the Rogue at low-water level.

In the stretch from Gold Beach to Agness I found no evidence of spawning having taken place in the river. Nowhere could I find any of the characteristic nesting areas in the water or on the beaches between the high-water mark and the then present water level. To be sure the time of my visit did not coincide with the spawning period of any species which occurs in the Rogue so that the absence of freshly formed nests was normal, but in spawning areas one can usually see distinctly traces of nests built a year or even more before the date of the inspection. If any spawning had taken place in this stretch of the river, then the intervening floods had been heavy enough to wipe out all the evidence. Equally clearly the spawning had been of no value since the nests had either been scoured out or covered so deeply that the eggs were killed. I have already called attention to the

film deposited on the bottom and on beaches between high and low water marks and have shown that it is thin, granular and broken. It is in no sense a blanket and would not interfere with the respiration of developing eggs if there were any in this region. Normally the fish cover the eggs by a layer of sand or fine gravel; the fresh water carrying oxygen easily penetrates this cover and the young wriggle out after the eggs hatch. A thin, broken layer such as I have already described would not interfere with the permeation of fresh water with oxygen and the development of such eggs as might be present. But I am clear that this is not a true spawning area. As Mr. Joseph Wharton said in an admirable paper on the salmon of the Rogue River, "It is the ambition of all these species of anadromous fish to ascend the river to the highest point attainable before making their spawning beds, seeking the waters that are purest and coldest." This statement is absolutely correct; in difficult streams or when held behind man-made barriers, these fish struggle to the end to make their way upstream and will sacrifice life rather than accept spawning areas in the lower reaches of the river. The urge which drives them on is the basis for the safety of the race. For the straggler or the weakling who may find the achievement of headwaters impossible, an enforced spawning in the lower river is of no significance; the river level varies too widely and its current at full flood is too fierce. Eggs deposited at high water will be exposed and die when the water falls; or if the spawning occurs at a lower water level, the next flood waters will bury the eggs or sweep them away. The suddenness, the violence and the irregularity of the changes in water level of the Rogue are conspicuous in the records of every year.

The spawning grounds lie chiefly at least above the region in which placer mining run-off is poured into the stream so that whatever the effect of this added burden it is not exerted in the spawning period or on the early stages of life of the new generation. Even though natural erosion contributed to the stream burden more material in time long past, and less abundantly and frequently in more recent years, still the fish, young and old, in the higher reaches of the stream held their own and maintained the run under natural conditions. Only when man introduced new barriers, devised new traps in diversion ditches which led away from safety, or discharged waste materials of un-

known and destructive type have the fish been unable to cope with the changes of the environment.

QUANTITY OF FISH FOOD PRESENT

My attention was early drawn to the question of the supply of fish food in the Rogue. The low-water season was naturally favorable for the study of this factor as the slow movement of the stream, its numerous shallows and the transparency of the water made it easy to observe the numbers and kinds of aquatic organisms present. I was impressed by the abundance and variety of the aquatic population. Both in the lower river and as far up as Rogue Elk I studied the forms which could be seen in different parts of the stream and recorded in my field notes the frequency with which organisms known to be fish food were met with on the trip. No attempt was made to secure a complete list or to determine precisely the species which were encountered. Such an undertaking would have demanded far more time than had been agreed upon for the study. Speaking generally and in a broad way, I am confident that the food supply of the fish is abundant and well distributed and also adequate to sustain a large run of fish.

One word of caution must be expressed here. No factor is more variable or spotty in my experience than the quantity of food to be seen in traveling along a stream. Conditions vary with every pool. At one moment on a good stream the student may see a veritable crowd of crayfish, insect larvae and smaller organisms and only a few yards away miss entirely some types abundant before, or even look long without seeing much of anything. The conditions of a stream cannot be determined by random sampling at a few places or on a single day. Fisherman's luck affects the student of river conditions also and fish food is as erratic apparently in habits and distribution as are the fish themselves.

Early in October I saw fish in pools where local fishermen were unable to attract them by flies or bait. The temperature of the water was a little higher than usual and the current slower so that the warmer, less oxygenated water may have made the fish logy. It seems possible that the abundant food was so easily caught that bait and lure were less attractive. Certain it is that neither natural nor artificial erosion up to date has exerted any demonstrable change in the fish food supply in the Rogue.

This discussion would not be complete if I omitted to mention certain ecological relations which indicate that the placer mine run-off may be of advantage to the fish. One of these is protection afforded by the turbidity of the water and the other is the suggested increase in the primitive food supply.

That adult fish are screened by the turbid waters is well known and often made the subject of comment by fishermen. In fact, they attribute the difficulty in catching fish to the amount of "waste" discharged by placer mines. I have already discussed the quantity of this discharge and called attention to the rapidity with which it settles. In Table III are given the muddiest water we could find; half the tests were 105 ppm or less, and four were only 30 ppm or less. Yet anyone standing on the bridge at the points where these samples were taken would say the water was too muddy for fishing; and it was too dense to see fish in the stream, but really contained very little sediment. This does not deter the fish from getting their own food.

Most significant is a possible relation of fine silt to the food of young fish. It has been shown that the presence of finely divided suspensoids of natural origin may be of advantage to the microbiota which constitutes the foundation element in the food supply of water. Studies on aquatic biology conducted by the Wisconsin Survey demonstrated that colloidal organic particles collect on

carbon and sand grains to build a culture medium for aquatic bacteria. The finest suspensoids and colloidal particles in the placer mine run-off would evidently function in this way and increase the supply of aquatic bacteria and other associated micro-organisms. Thus would be multiplied the food supply of protozoa and other types of aquatic life which subsist primarily on bacteria. Among such are young stages or larvae of small crustaceans and insects which form such an important part of the food of young fish at the start of life. It is even possible that colloidal particles encased by bacterial cultures may form an element in the direct food supply of young fish.

I have on many occasions dissected under the microscope very young fish from muddy waters and found to my surprise that the alimentary canal was filled to repletion with what was apparently only mud, even though the fish were healthy and vigorous. Instead of being merely inert material taken in by chance with small organisms floating in the muddy water, this mass may represent particles coated with a layer of zoogloea, or bacterial jelly, that is in itself of nutritive value. But whether under circumstances the fine material may have any positive worth for the growth or nourishment of the fish, I am clear that evidence thus far obtained from many streams, and at many times, shows that such material does not under conditions already outlined do damage to the gills or to the digestive system even of the young fish at the most susceptible period of life.

APPENDIX A

EXTRACTS FROM REPORT ON ROGUE RIVER TURBIDITY

By ARTHUR M. SWARTLEY

Transportation methods. Material is moved by transportation, in suspension and as dissolved matter.

Traction is the method by which the particles, too coarse to be carried in suspension, are moved forward upon the bottom of the stream by sliding, rolling, or in short jumps.

Suspension is that method of stream transportation wherein the small particles are lifted above the bottom for considerable time and distance. The larger particles in suspension are largely dependent upon velocity, the smaller particles are somewhat independent, while colloidal material is almost independent of it.

With lowering of velocity the larger particles in suspension drop to the bottom and become a part of the tractional movement. If the currents proceeded in straightforward movement as in a flume, the suspended particles might soon go to the bottom except those of colloidal size.

Solution material is independent of velocity in its forward movement.

Material in solution and suspension is mostly carried out to sea at once or within a short time, once it reaches the larger tributaries. A minor part of this fine material may be left behind where streams pass through occasional valleys and remain there indefinitely. The bulk of these valley deposits are of the larger particles such as coarse sand, gravel and boulders. The lateral migration of streams and the deepening of their channels may leave benches of gravel well above the flood-water level to remain for ages to be affected only by the slower agencies of erosion, like rain, to transport it to a nearby stream.

These stream beds, benches and valley deposits are of necessity no different than the material that is continually migrating to sea from the narrow canyons, and their more rapid flowing streams. The material is derived from the same places but was stopped because the channel widened out and the grade lessened so that the stream was not competent to carry the load. If the erosion is from a mountainous area containing gold, platinum and the other heavy metals, these will be deposited in

the valley along with the boulders, gravel and sand, but at best these are only incidental. Their presence there is of interest to the placer miner, but to others it is only of academic interest until such time as placer mining begins and mining debris is being dumped into the stream. If there enters into the problem here being discussed and a more particular description of its nature is pertinent, whether in transit or sidetracked for a time in the valley or on beaches to await removal by the agencies of nature or of man, and the material transported along the bed of the stream whether gravel or sand is essentially no different than the solid rock from which it came. Water flowing over it is as clear as though it were flowing over solid rock. In flood periods it is in slow motion, the deeps being deepened and the shallows being filled and broadened. When the flood recedes the deeps are slowly filling from the shallows. Each flood makes its contribution to its downstream movement. That it does not shallow the pools as the years go by is well known to all observers of the habit of streams. It is composed of small rock fragments and contributes practically nothing to the composition of the water, either chemically or in turbidity. It is chemically inert and has no oxygen demand and therefore takes away from the flowing stream nothing which the fish require. This is equally true of this material whether placed in transit by nature or by man, since they are alike in nature, come from the same places, and are only being accelerated by man in their journey to the sea.

The material carried in suspension varies from fine sand to particles almost infinitely small. Speaking in sizes, the fine sand, which is about the very coarsest material carried in suspension, ranges from a maximum of 1/100 of an inch in diameter down to 1/200 inch; very fine sand 1/200 inch to 1/400 inch; silt 1/400 inch to 1/6400 inch; and clay 1/6400 inch and finer. The coarse sizes of fine sand are now in suspension, now in traction, dependent mainly upon the velocity of the stream under flood conditions.

Along with the above described materials which are merely minerals in a fine state of subdivision, are the colloids. Colloids are the more

finely divided particles altered physically and chemically, usually combined with water, and frequently jelly-like. Material in solution is fully dissolved matter; it is composed of various substances and varies in the different streams, dependent upon the rock found in each watershed, and it contains practically all the elements found in the suspended material, such as silicon, iron, calcium, magnesium, sodium, and potassium combined with oxygen or as carbonates, sulphates, nitrates, and chlorides, plus the decomposition products of vegetation.

It is to be noted that all the materials entering the streams, whether placed there by nature or by man, whether coarse or fine, whether travelling upon the bottom, in suspension or in solution, are almost altogether inert, suffer little change on their way to the sea, and having reached the end point of chemical change have no further need of oxygen, therefore not robbing the water of its

oxygen which the fish demand, or adding to the water toxic agents injurious to fish or fish life.

From various sources data on the Rogue River and other streams, not subjected to influence of mining projects, show a range of parts per million and an average turbidity as follows:

	<i>Parts per million</i>	<i>Average turbidity</i>
Rogue River at Copper Canyon (estimated)	321	.....
Snake River at Welser, Idaho	324	80
Owyhee River at Owyhee, Oregon	395	167
Klamath River at Klamath Falls, Oregon	146	.....
Umatilla River at Umatilla, Oregon	247	79
John Day River at McDonald, Oregon	324	245
Columbia River at Cascade Locks, Oregon	137	27
Colorado River (flood conditions)	21,500	.....
Rio Grande	14,840	.....

APPENDIX B

EXPERIMENTS ON TOLERANCE OF YOUNG TROUT AND SALMON FOR SUSPENDED SEDIMENT IN WATER

By Dr. L. E. GRIFFIN, Reed College

The experiments which are described in the following account were undertaken to obtain definite information as to the direct effect of large amounts of soil sediment in water upon the fish inhabiting such water. The Department of Geology and Mineral Industries of the state of Oregon arranged with me for experimental studies on this question. I have been ably assisted in carrying on the studies by Mr. Harry Beckwith of Reed College.

The experiments covered two periods: One of three weeks, the other of four weeks. In the first period the fish tested were cutthroat fingerlings; in the second, young chinook salmon. The fish were kept in troughs, similar to those used in fish hatcheries, in which a depth of five inches of water was maintained. The water was kept flowing by circulation through a centrifugal pump, and aeration was secured by ejection of the water into the troughs in a heavy spray. The pumps used were small, limiting the flow of water to a rate of about one-half mile an hour. The slow streamlike movement of the water along the troughs was sufficient to keep a much heavier load of fine sediment in suspension than is ordinarily found even in muddy streams, but was not rapid enough to keep in suspension all the sediment which was put into the troughs, or to maintain a turbidity of more than 750 parts per million for 24 hours.

The material used for the sediment consisted of soil and alluvial material taken from ten spots around the Esterly mine, near O'Brien, Josephine county, Oregon, which were representative of the alluvial soils of that region. The samples were thoroughly mixed; when material was needed for the tests, the dirt was mixed with water and the portion which settled quickly was rejected. When the remaining fine sediment was placed in the fish troughs it was found that a considerable portion settled out at a regular rate during the first six hours after it was put in, but that after that period the amount of suspended silt remained nearly constant. As the sediment which settled in the troughs was stirred and strained daily, and occasionally fresh soil was added, the water of

the experimental trough carried a heavy load of sediment for a few hours of each day and a lighter but constant load for the remainder of the day.

After several preliminary experiments in which apparatus and methods were tested, the first trial run was begun. Two troughs were arranged parallel to each other in a dimly lighted, unheated building. The water with which the troughs were filled came from a spring-fed stream on the Reed College campus, in which trout are living and breeding. One trough contained the sediment-laden water, the other clear water. Aside from the processes needed to keep the sediment in suspension, both troughs and the fish placed in them were treated in the same manner.

December 11, 1937, 90 cutthroat trout fingerlings, 2 to 2½ inches in length, were secured from the federal hatchery at Clackamas, Oregon. Fifty of these were placed in the sediment-containing trough, 40 in the clear-water trough. The experiment continued until December 30. At the time of the daily stirring (at which time fresh sediment was occasionally added) the load of sediment varied from 2,300 to 3,500 parts per million by weight. This was enough to make the water a dark brown color, and so opaque that a hand held an inch under the surface was invisible. The load of sediment fell rapidly during the first hour, and then more slowly, until after the sixth hour an almost constant load was carried for the remainder of a 24-hour period. This constant load varied from day to day from 360 ppm to 600 ppm, being 500 or more ppm on all but six of the 19 days during which the test lasted.

The fish were fed with the same food used in the hatchery from which they came. Those in the clear water usually did not feed until the operator had backed away from the trough. In the muddy water the fish were not seen to feed for the first two days, but after that they rose to the surface and fed actively as soon as particles of food began to fall on the surface of the water. The trout in the clear water remained nervous throughout the experimental period, while those in the muddy water became bold enough to peck at the operator's hand when it was placed in the water. Because of

the necessity of scraping the bottom of the trough, stirring up the silt, and adding fresh soil, fish in the sediment trough were disturbed much more than those in the clear water.

When the test was ended on December 30, it was found that a much larger proportion of the fish in the sediment-containing trough had survived (56%) than in the clear-water trough (10%). There was no noticeable difference in the color of the surviving fish in the two troughs, and the fish which had lived in the muddy water were as large as the survivors from the clear-water trough.

On January 12, 1938, a second experiment was begun in which 150 chinook salmon fingerlings, $1\frac{3}{4}$ to 2 inches long, were divided equally between the two troughs. This time the sediment was placed in the trough which had contained clear water in the previous experiment, and the other trough was used for clear water. Care was taken to reduce all movements near the troughs to those absolutely necessary to conduct the test. During the period of this test, which lasted 28 days, until February 9, the load of sediment was greater than in the first test. The maximum load at the time of stirring was from 3,100 to 6,500 ppm on most days. The constant load after the sixth hour was from 300 to 480 ppm from January 12 to January 25; and from 650 to 750 ppm from January 26 to February 9, except on two days when the load fell to 380 and 410 ppm.

The salmon fingerlings in the clear water at first showed the same nervousness as the trout, but after a week those which survived were not easily disturbed and fed avidly. The young salmon were not seen to feed in the muddy water quite so quickly as the young trout, and when they were seen they took food more deliberately than the trout. After the fish became accustomed to the new conditions of their lives and to the movements of the operator, those in both troughs fed satisfactorily.

Most of the salmon fingerlings in the muddy water were considerably lighter in color than the controls at the close of the test, though a few had not changed color. The fish of the muddy water were also irregular in growth, some having grown as much as the controls, while some were noticeably smaller.

At the close of the 28-day experimental period, 88% of the fish kept in the muddy water were alive, while 36% of the controls lived. Most of the controls which died did so during the first three days of

the test; after which time there is no significant difference in the death rate of the two lots of fish.

On examining the day-by-day record one is struck by the heavy mortality which occurred on the third day of both experiments among the fish kept in the clear-water trough. This was not due to special conditions in one of the troughs, because the troughs were reversed for the two experiments. It could not be determined whether the fish kept in clear water were more active than those in the muddy water trough because the latter were invisible most of the time. The fact that more of the fish in clear water jumped over the ends of their trough indicates that they were more nervous. It was evident also that the fish in clear water were more disturbed by movements of the observers, changes of light intensity, etc., than the other fish.

In the second experiment the electric lights in the dimly illuminated aquarium room were not turned on, so that disturbance was avoided; but it was necessary to scrape the bottoms of the troughs, adjust screens and strainers, and perform other necessary actions daily. All these disturbed the fish in clear water much more than those in the muddy water. When excited, the fish frequently darted against the sides of their trough with considerable force. On several occasions startled fish were seen to strike the side of the trough with sufficient speed to stun themselves. It seems possible that the high mortality of the fish in clear water during the first week of both experiments was due to the injuries they inflicted upon themselves when excited. After a few days the fish became accustomed to their living conditions and to the movements of the operator in and around their trough, and then were excited much less easily.

After the first week the mortality among the young trout of the first experiment was almost the same in both troughs; 13 in the muddy water, 11 in the clear water. As the cutthroat trout fed well and grew normally in the muddy water, the conditions there do not seem to have been unfavorable for these fish.

After the first week of the second experiment, with young salmon for subjects, 9 died in the muddy water trough and 2 in the clear water. But after the heavy loss discussed above only 29 remained alive in clear water and 74 in muddy water, so that the difference in mortality is relatively about the same.

The results of the experiments indicate that young trout and salmon are not directly injured by

living for considerable periods of time in water which carries so much soil sediment that it is made extremely muddy and opaque. They also indicate that cutthroat trout and salmon fingerlings can feed and grow apparently well in very muddy water.

The sediment load of the water in these experiments was continuously much greater than it is in the ordinary muddy stream. Water taken from the Willamette River at flood stage after three days of heavy winter rains, and when the river water appeared to be extremely turbid, contained only 42 ppm of sediments.

While the results of these experiments throw some light on the problems which were under con-

sideration, it seems desirable that more extensive tests should be undertaken, in order to secure a larger accumulation of data, and to investigate factors which could not be studied in the limited time or with the apparatus available for these experiments.

EXPERIMENT II Chinook Salmon Fingerlings

Date	Water Temperature	Sediment Stirred	Sample Taken	Parts per Million	Tank 1 with Sediment		Tank 2 with Clear Water	
					Dead	Living	Dead	Living
Jan.	F.							
12	58.0	†			0	75	0	75
13	58.0				0	75	1	74
14	58.0				0	75	40	34
15	58.0				1	74	5	29
16	58.0				0	74	0	29
17	58.0	9:00 am	9:30 am	820	0	74	0	29
18	58.0	9:00 am	9:30 am	950	0	74	0	29
19	58.0				0	74	0	29
20	58.0	9:00 am	9:30 am	960	0	74	0	29
21	58.0	9:00 am	9:30 am	1100	0	74	0	29
22	58.0	9:00 am	9:30 am	1350	0	74	0	29
23	58.0	3:00 pm	3:30 pm	1240	0	74	0	29
24	58.0	3:00 pm	3:30 pm	1600	1	73	1	28
25	57.2				1	72	0	28
26	57.2	3:00 pm	3:30 pm	2130	1	71	0	28
27	55.4	11:30 am	4:00 pm	930	0	71	0	28
28	55.4	9:00 am	9:30 am	2050	0	71	0	28
29	55.4	9:00 am	9:30 am	1670	0	71	0	28
30	53.6	9:00 am	9:30 am	1520	0	71	0	28
31	53.6	9:00 am	9:30 am	2120	0	71	0	28
Feb.								
1	53.6	11:30 am	4:00 pm	850	2	69	0	28
2	53.6	9:00 am	9:30 am	1480	0	69	0	28
3	53.6	9:00 am	9:30 am	1060	1	68	0	28
4	55.4				0	68	0	28
5	60.8	6:00 am	6:30 am	2317	3	65	0	28
			12:30 pm	841	0	65	0	28
			8:00 pm	770	0	65	0	28
6	60.8				0	65	1	27
7	60.8	6:00 am	6:30 am	2150	0	65	0	27
			12:30 pm	780	0	65	0	27
			8:00 pm	760	0	65	0	27
8	60.8				0	65	0	27
9	60.8	4:00 pm	4:01 pm	5960	0	65	0	27
Totals					10	65	48	27

From January 12 to 16 silt was added to the sediment trough daily in order to build up the load of suspended matter to a maximum. The load of suspended material was somewhat greater than during the first experiment.

* Four of these jumped over the screen at the outlet and were killed in the pump; six leaped over the side at the inlet end, which was not covered by mosquito netting as was the rest of the trough.

† Fish put in trough.

EXPERIMENT I Cutthroat Fingerlings

Date	Water Temperature	Sediment Stirred	Sample Taken	Parts per Million	Tank 1 with Sediment		Tank 2 with Clear Water	
					Dead	Living	Dead	Living
Dec.	F.							
11	62.6	5:00 pm	6:00 pm	840	0	50	0	40
12	62.6	9:00 am	10:00 am	760	0	50	0	40
13	62.6	9:00 am	9:30 am	1190	1	49	12	28
			4:00 pm	520	0	49	0	28
14	62.6				2	47	3	25
15	62.6	9:00 am	9:30 am	1140	0	47	0	25
			4:00 pm	690	3	44	8	17
16	62.6	9:00 am	9:30 am	1130	0	44	0	17
			4:00 pm	390	3	41	2	15
17		No record			0	41	0	15
18	62.6	9:00 am	9:30 am	990	0	41	0	15
			4:00 pm	480	5	36	5	10
19	62.6	9:00 am	9:30 am	1040	1	35	1	9
20	62.6	9:00 am	9:30 am	990	0	35	0	9
			4:00 pm	500	0	35	† 1	8
21	60.8	9:00 am	9:30 am	750	1	34	0	8
22	60.8	9:00 am	4:00 pm	560	† 4	30	0	8
23	58.0				0	30	0	8
24	57.2				1	29	1	7
25	58.0				1	28	0	7
26	58.0				0	28	2	5
27	58.0				0	28	0	5
28	58.0				0	28	1	4
29	58.0				0	28	0	4
30	58.0				0	28	0	4
Totals					22	28	36	4

Circumstances made weighing impossible from December 23 to December 30; conditions of the troughs were kept the same as they had been.

* Two of these jumped over the end screen and were carried through the pump.

† Killed by the pump.

‡ One killed by the pump.

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